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A CONTRIBUTION TO THE KNOWLEDGE OF SOME NORTH AMERICAN CONIFERÆ.

By Edson S. Bastin and Henry Trimble.

(*Continued from page 39.*)

GENERAL CHARACTERS OF THE PINASTER GROUP.

The pines of this group differ from those of the Strobus group already studied, not only in the fact that their wood is darker, harder and more resinous, but in the structure of their cones and leaves. The scales of the cones are usually thicker and more woody, the apophysis, particularly, is considerably thickened and the umbo is dorsal instead of being terminal, and, instead of being unarmed, is usually armed with a spine, more or less strongly developed. The scaly sheaths at the base of the leaves are much more persistent, and the leaves are most commonly in twos or threes, though in a few species they are in fives, the same as in the white pines.

PINUS RIGIDA, MILLER.

PITCH PINE.

GENERAL CHARACTERS.

This tree is native to the eastern part of our continent, ranging in habitat from New Brunswick to the mountains of northern Georgia, and from the coast westward to eastern Kentucky and Ohio. It frequents rocky or thin, sandy soil, and under favorable conditions attains a height of 80 or 90 feet. Its outer bark is dark and rough, and its wood quite hard and resinous.

Its leaves are in threes, or more rarely in twos, from short sheaths, and are from 3 to 5 inches in length, dark green in color and rather

coarse and rigid. Its cones are from 1¼ to 3¼ inches long, ovate-conical, frequently in clusters of two or three, and the scales are tipped with a short recurved prickle.

MICROSCOPICAL STRUCTURE.

The leaves in cross-section showed two flat and one convex surface, the latter much wider than either of the others, so that the two flat surfaces formed a very obtuse angle with each other. The epidermis and endodermis were somewhat cutinized, and in mature leaves epidermis, hypoderma, pericycle, endodermis and xylem were all more or less lignified. Hypoderma composed of one or two layers of thick-walled fibres interrupted at frequent intervals on all

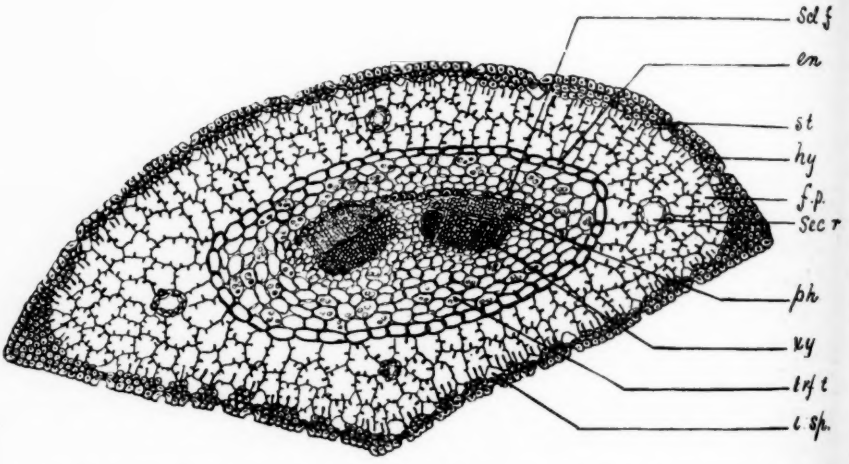

Fig. 8, cross-section of leaf of Pinus rigida, magnified 65 diameters. *Scl, f*, sclerenchyma fibre on the exterior border of the phloem; *en*, cell of the endodermis; *st*, stoma; *hy*, fibrous tissue of the hypoderma; *f, p*, folded parenchyma composing the mesophyll; *sec, r*, secretion reservoir; *ph*, phloem of one of the bundles; *xy*, xylem of one of the bundles; *trf, t*, transfusion tissue composed of short tracheids with bordered pits; *i, sp*, intercellular space over stoma.

sides by the stomata. Stomata in longitudinal rows, about twenty-two rows in all on each leaf. Mesophyll composed of rather large cells, and imbedded in it were about four secretion reservoirs, one opposite each of the three angles of the leaf, and one opposite the middle of the convex surface. About the reservoirs were a few thick-walled strengthening cells in a circle composed mostly of

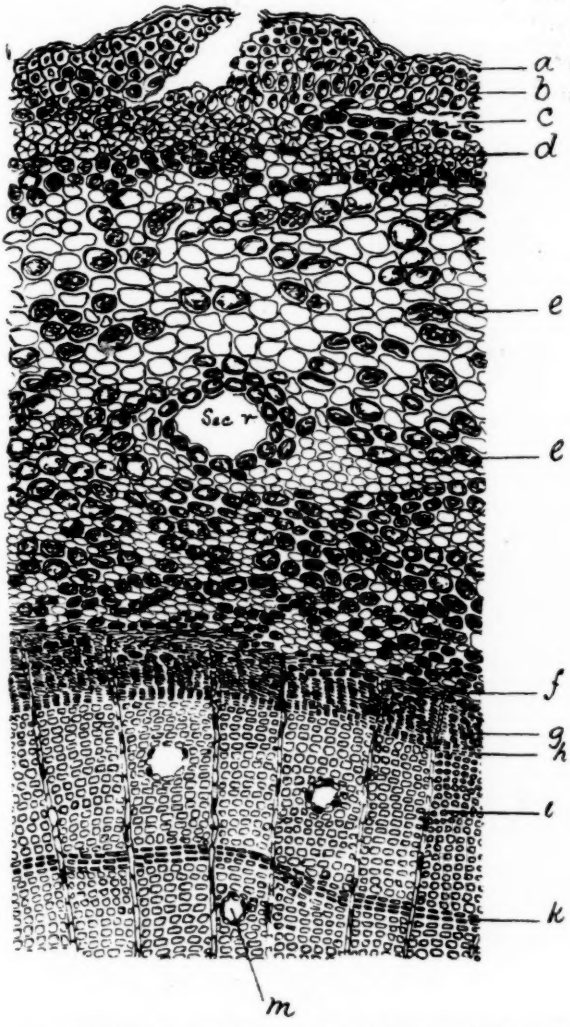

Fig. 9, part of cross-section of stem of P. rigida, magnified 75 diameters; *a*, cutinized and very thick-walled epidermis; *b*, hypodermal tissue; *c*, fissure; *d*, sclerotic or stony tissue; *e*, *e'*, tannin cells in middle bark; *f*, collapsed sieve tissue in older bast; *g*, newer sieve tissue; *h*, cambium zone; *i*, tracheids of xylem; *k*, ring of growth; *m*, secretion reservoir in the wood; *sec*, *r*, secretion reservoir in bark.

This drawing, as well as that of the stems of P. Austriaca and of P. palustris, was made from a specimen which had been treated with a solution of ferric chloride in absolute alcohol, and is intended to show the distribution of tannic matters.

much thinner-walled ones. The endodermis was rather large-celled; the pericycle was many-layered and composed of discigerous tracheids; interior to these were two open collateral bundles, each with about four one- or two-rowed medullary rays. A few thick-walled fibres occurred at the outer ends of the phloem masses, but they did not form a continuous layer. (See *Fig. 8.*) The oleoresin of the leaf seemed to be nearly confined to the secretion reservoirs and the secreting cells immediately surrounding them.

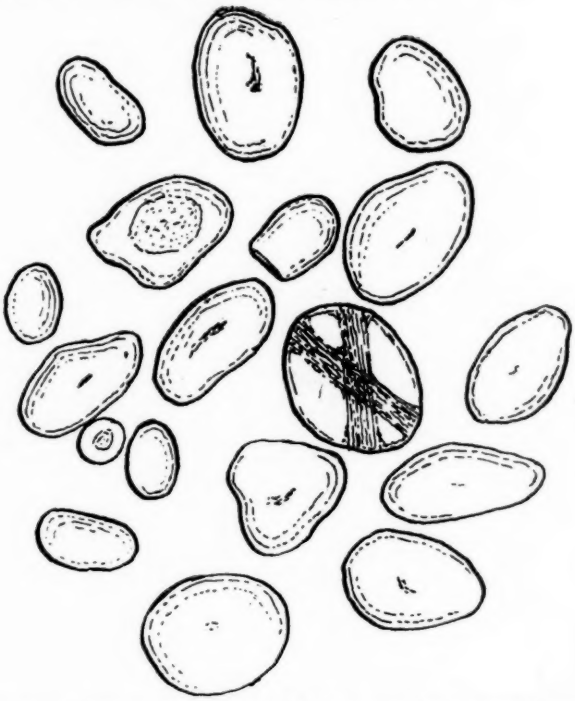

Fig. 10, starch from root of Pinus rigida, magnified 1,200 diameters. The granule marked with a cross shows the effect of polarized light. The grain has few and very faint markings, even the hilum being in many instances difficult to recognize except by the aid of polarized light.

Most of the mesophyll cells contained some tannin and a considerable proportion of them were very rich in it. It also occurred in the phloem tissues of the bundles, but only to a slight extent elsewhere in the leaf.

A cross-section of a twig two or three years old showed the following structure:

At the exterior the strongly cutinized and somewhat lignified epidermis may still persist, supported underneath by collenchyma. At a depth of several layers of cells underneath the epidermis, there was found a phellogen, which gave rise to layers of stone and cork cells. Interior to this was the ordinary cortical parenchyma, consisting mostly of rather large, thin-walled cells, which were tangentially elongated. This region contained secretion reservoirs, which appeared round or elliptical in cross-section, but were seen in longitudinal section to form long tubes. There were in this portion of the cortex few, if any, lignified elements. The older portion of the bast layer consisted for the most part of collapsed and ill-defined sieve elements. In the newer bast the walls of the individual sieve tubes were well defined, but the cells were of small diameter. Scattered among the sieve tubes were cells of larger diameter, mostly containing secretions, some oleoresin, others apparently mucilage. The wood had substantially the same structure as that already described in Pinus Strobus.

Oleoresinous matters abounded not only in the secretion reservoirs of the bark and wood and in the secretion cells about them, but in many scattered cells of the cortical and bast layers, in some of the medullary ray cells, and even in some of the tracheids of the xylem. Tannin was abundant in the bark, in all parts of it and in the cambium. It also occurred, though less abundantly, in the xylem, particularly in the secreting cells about the resin tubes and in the medullary rays. The distribution was, in fact, similar to that already described in Pinus Strobus, though the latter species appeared to contain considerably less of it. The drawing (*Fig. 9*) was made from a section which had been treated with a solution of ferric chloride in absolute alcohol. The color of the precipitate was greenish black.

CHEMICAL COMPOSITION.

The leaves of Pinus rigida were not examined chemically, because at present they possess no apparent economic value. As pointed out in the preceding description of the microscopical characters, the oleoresin is the most abundant constituent of the bark. Tannin was also found to be present in creditable amount, but mucilage was found in much smaller proportion than in P. Strobus. A sample of the stem bark, collected in November, yielded the following percentages of astringent principle:

	Per Cent.
Moisture	9·00
Ash in absolutely dry bark	1·03
Tannin in air-dry bark	14·63
Tannin in absolutely dry bark	16·07

The tannin was indicated to be of the oak bark variety by the following reactions:

Ferric chloride: green color and precipitate.
Bromine water: yellow precipitate.
Lime water: purplish precipitate.

The ash was composed of calcium phosphate, with some sulphate and carbonate.

ECONOMICS.

Pitch Pine is valued chiefly for its oleoresin, which, however, is in such abundance as to interfere with its usefulness as lumber. It was, in Colonial times, a source of turpentine in the Northern States; and in southern New Jersey, western Pennsylvania and parts of New England it has been used as a source of tar. The abundance of resin has made the wood valuable for fuel, and a very good quality of charcoal has been prepared from it.

PINUS AUSTRIACA, HÖSS.

AUSTRIAN PINE, BLACK PINE.

GENERAL CHARACTERS AND DISTRIBUTION.

The Austrian pine is regarded as a variety of the Corsican pine of Southern Europe, Pinus Laricio, Poiret. It is considerably cultivated in this country as an ornamental tree. It is a rough-boled, rough-branched, massive-topped tree, which does not attain any great height. Its buds are rather large, its leaves dark green, rigid, chiefly in twos, 4 to 6 inches long, mostly with one flattish and one strongly convex surface.

MICROSCOPICAL STRUCTURE.

The stomata were in longitudinal rows on both surfaces; hypoderma of two or three rows of fibrous, thick-walled cells; mesophyll cells of small or moderate size; usually about six secretion reservoirs, nearly equidistant from one another in the mesophyll, and each strengthened by a complete circle of thick-walled cells, the stele including two fibro-vascular bundles, each with about six medullary rays. There were observed a few scattered thick-walled fibres at the outer end of the phloem masses, and near the xylem ends of the bundles were frequently one or two small secretion reservoirs.

The structure, in other respects, was found to be similar to that of the leaf of P. rigida.

The cross-section of a twig of this species showed a structure not unlike that of P. rigida, except that the secretion reservoirs appeared to be rather more abundant, both in the bark and in the wood.

The distribution of oleoresinous matter was otherwise similar, and the distribution of tannin was also similar. (See *Fig. 12.*)

An examination of the roots of these two species did not reveal any decided differences between their structure and that of the

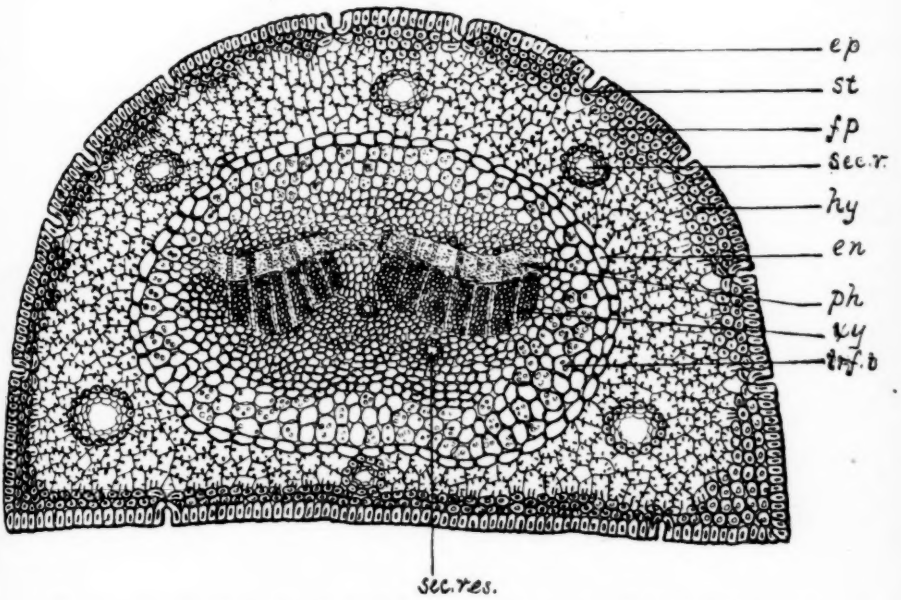

Fig. 11, cross-section of leaf of Pinus Austriaca, magnified 65 diameters; *ep*, epidermis; *st*, stoma; *f*, *p*, folded parenchyma composing the mesophyll; *sec*, *r*, secretion reservoir; *hy*, hypodermal fibres; *en*, endodermis; *ph*, phloem; *xy*, xylem; *trf*, *t*, transfusion tissue; *sec*, *res*, small secretion reservoir in the stele.

stems of the same species, except, of course, such differences as generally exist between root and stem structures. The wood of the roots, however, was larger-celled, and the cells thinner-walled, making the structure more spongy. The bark of both roots seemed to possess somewhat less tannin than that of the stems, and the parenchyma cells, both of the bark and medullary rays, were rich in starch, while the corresponding cells of the stem contained very

little, and that relatively very fine-grained. The wood of the roots appeared to be somewhat richer in tannic matters than that of the stems.

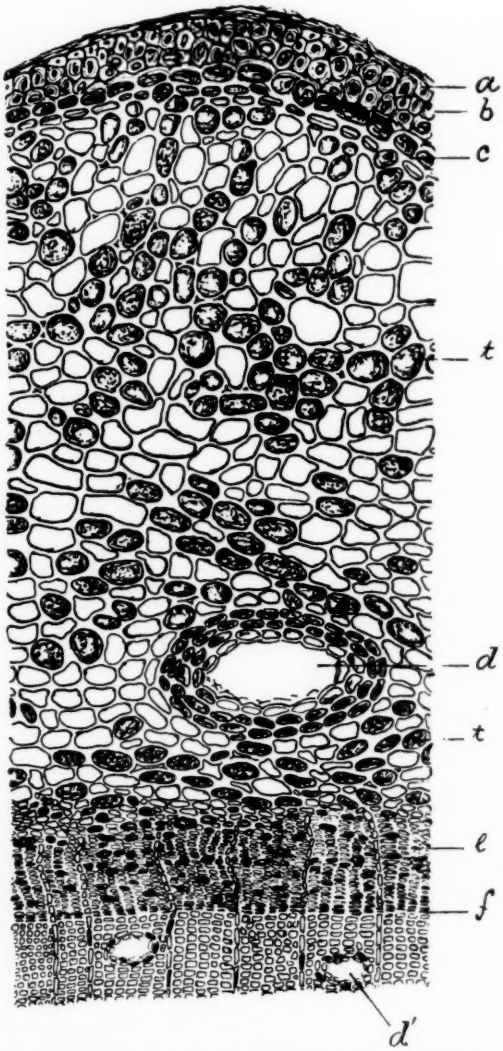

Fig. 12, part of cross-section of stem of Pinus Austriaca, magnified 75 diameters; *a*, epidermis; *b*, hypoderma; *c*, phellogen layer beginning to form; *d*, secretion reservoir in middle bark; *e*, bast layer; *f*, cambium zone; *d'*, secretion reservoir in wood; *t*, *t'*, tannin cells. All of the cells whose contents are strongly shaded contain tannin.

CHEMICAL COMPOSITION.

For the purposes of this investigation, a tree of Pinus Austriaca, about 6 feet in height, was taken from a nursery near Philadelphia, in November. As is well known, the oleoresin is an important constituent of this tree, but no investigation of that substance was made. Mucilage was found to be present in moderate proportion.

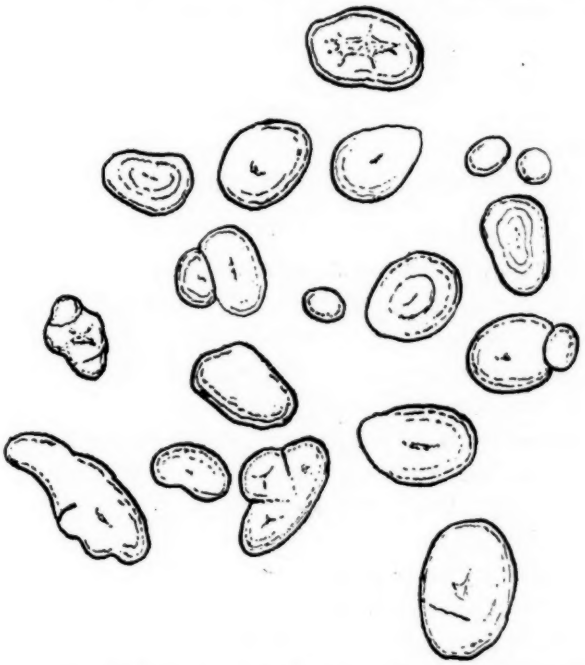

Fig. 13, starch from the root of P. Austriaca. The grains are smaller, more distinctly marked, and more commonly compound than in P. rigida.

The tannin, moisture and ash were estimated in the several parts of the tree, with the following percentage results:

	Moisture.	Ash in absolutely dry state.	Tannin in air-dry state.	Tannin in absolutely dry state.
Leaves	6·70	3·05	3·56	3·86
Trunk bark	7·25	2·17	13·58	14·64
Root bark	5·96	2·73	11·12	11·82

The tannin from all of the parts gave a green color and precipitate with ferric chloride, and a yellow precipitate with bromine water, thus indicating its probable identity with that from oak bark. The ash consisted of calcium phosphate, with some sulphate and carbonate.

ECONOMICS.

So far as this country is concerned, the Austrian pine is used only as an ornamental tree, for which purpose, however, it is in unusual favor. In its native locality, Austria and southern France, it, with the closely related Pinus Laricio, furnishes a considerable quantity of turpentine.

PINUS PALUSTRIS, MILLER.

LONG LEAVED PINE, SOUTHERN YELLOW PINE.

GENERAL CHARACTERS AND DISTRIBUTION.

The stem and leaves of this species have been studied microscopically, and the leaves and bark chemically. The long-leaved pine is one of the most valuable members of the genus. It is the chief source of the terebinthinous products of this country, and its wood contributes no small part to the lumber industry.

According to the "Report of the Chief of the Division of Forestry" for 1891, this pine is distributed through all the South Atlantic and Gulf States, at some distance from the coast, and covering a belt about 125 miles in width, interrupted only by the alluvial plains of the Mississippi and Red Rivers, in Louisiana and Texas. In addition, there is found in western Georgia and Alabama an extension in islands or patches, northward to latitude 34·5°. In Virginia this species has become almost extinct, being replaced by the loblolly pine.

In North Carolina the forests exclusively of long-leafed pine begin south of Bogue Inlet, with a width of 95 to 125 miles inland, and extending southward to the State line, covering about 6,500,000 acres; this is largely tapped for turpentine.

In South Carolina the pine belt is 150 miles wide, much of which is still untouched. In Georgia the flat woods of the shore have mostly been stripped of this pine, but the vast interior plane of 17,000 square miles is almost exclusively covered with it. In Florida it may be traced on the Atlantic Coast as far north as St. Augustine. In western Florida, large areas are pretty well ex-

hausted. The Gulf Coast pine belt, covering some 40,000 square miles, shows no difference from the Atlantic forest.

The upper division of the pine belt, a region of mixed growth in Alabama on a broken surface, covers about 23,000 square miles, while the belt of drift deposit which crosses the State contains about 1,000 square miles, covered with long-leaf pine of excellent quality and large yield per acre. The drift deposits along the Coosa River, covering about 300,000 acres, and a detached portion of 60,000 acres, are covered with pine of fine quality, hardly yet touched.

In Louisiana, on the eastern side of the Red River, there is a somewhat isolated area of long-leafed pine, estimated at 1,625,000 acres, and in Texas a similar area of 5,000 square miles; in neither State has this vast supply been tapped for turpentine to an appreciable extent.

The long-leafed pine tree is tall, straight-boled, has a thin-scaled bark, and a very hard, resinous wood. The stem separates near the summit into several diverging branches, giving the tree a flattish top. The leaves are in threes, or rarely in fours, from 10 to 15 inches long and subtended at the base by a conspicuous scaly sheath, from 1 inch to 1½ inches long. The leaves are crowded at the ends of the branches. The cones are terminal, from 6 to 10 inches long, conical or oblong-conical, the scales thick and armed with a short recurved spine.

MICROSCOPICAL STRUCTURE.

The leaves in cross-section showed the following structure: Triangular, with two flattish sides and one broader, convex one. The epidermis on all sides was perforated by stomata, which are arranged in nearly equidistant longitudinal rows on the different sides. There were observed from sixteen to twenty rows in all. The hypoderma consisted of from two to four layers of thick-walled fibrous cells, interrupted where the stomata occurred. The mesophyll cells were of medium size, and with the walls folded as in other species of Pinus. The secretion reservoirs were usually about four, arranged as in the leaf of P. rigida, except that they occurred close to the endodermis. The endodermis was large-celled, enclosing a pitted pericycle tissue of many layers, within which laid two collateral fibro-vascular bundles. At the outer end of each phloem mass was a double row of thick-walled fibrous cells. At the outer end of each xylem mass was a loosely arranged parenchyma, usually with large intercellular

spaces, and still further outward, next the pitted pericycle tissue, was an arc of thick-walled fibres in one or two rows.

The distribution of tannin in the leaf was found to be similar to that already described in the leaf of P. rigida.

A cross-section of a stem of one year's growth showed the following structure: At the exterior a thick-walled, small-celled epidermis, supported by a much larger-celled hypoderma, whose cells were somewhat lignified, but much thinner-walled. This was succeeded internally by a few layers of stony tissue, abutting on a layer

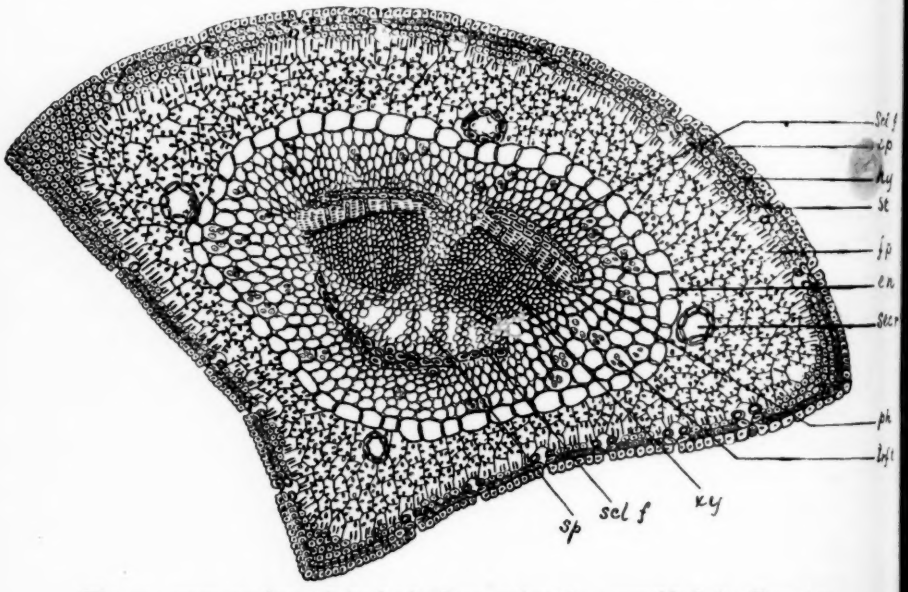

Fig. 14, cross-section of leaf of Pinus palustris, magnified 65 diameters. *Scl, f*, sclerenchyma fibres bounding the bast on the outside; *ep.*, epidermis; *hy*, hypodermal fibers; *st*, stoma; *f p*, folded parenchyma composing mesophyll; *en*, endodermis; *sec, r*, secretion reservoir; *ph*, phloem of one of the bundles; *trf, t*, pitted pericycle or transfusion tissue; *xy*, xylem of a bundle; *scl, f*, sclerenchyma fibers protective to the xylem; *sp*, intercellular space.

of phellogen. Interior to the phellogen succeeded a considerable thickness of large-celled parenchyma, through which were scattered stone cells, either singly or in clusters of from two to eight or more. Here also occurred secretion reservoirs, which, in structure and distribution, did not differ materially from those of the other species described. Now and then, also, a crystal cell containing crystals of calcium oxalate, similar in appearance to those already described in

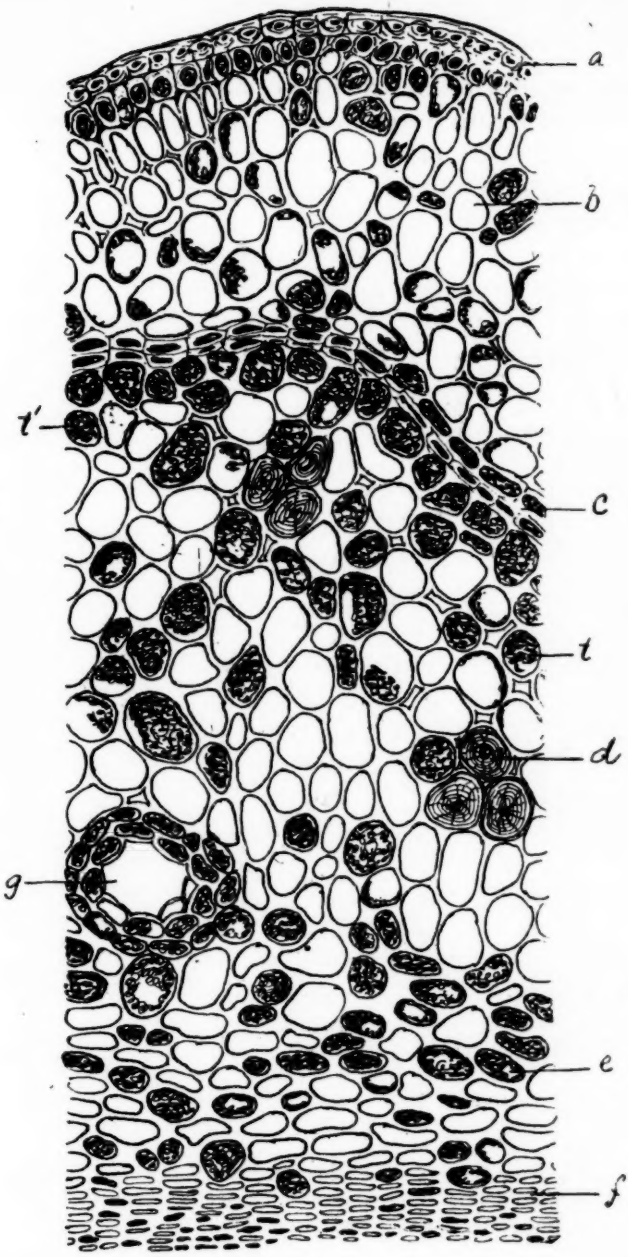

Fig. 15, portion of cross-section of stem of Pinus palustris, extending from epidermis nearly to the cambium zone, magnified 75 diameters. *a*, thick-walled epidermis; *b*, hypodermal tissues; *c*, area of thick-walled cells formed from a phellogen layer; *t*, tannin cell; *d*, stone cell in cortex; *e*, tannin cell; *f*, bast tissue.

P. Strobus, was observed. The bast, cambium and xylem layers were observed to be similar in structure to those already described in the other species. The principal structural difference between this stem and the stems of the other species was the larger average

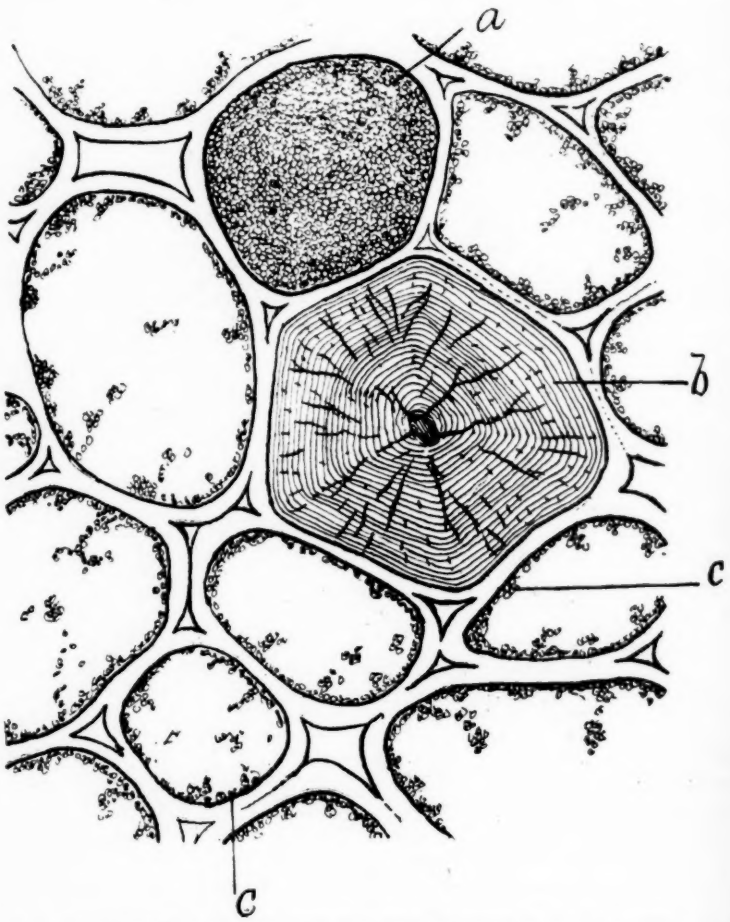

Fig. 16, small portion of cortex of P. palustris, magnified 300 diameters. *a*, tannin cell, containing tannin in great quantity; *b*, stone cell; *c*, *c'*, ordinary parenchyma cells, containing a little tannin.

size of the bark cells and the presence of scattered stone cells in the middle layer. The cells were also obviously much richer in oleoresin. The alkannin test showed its presence in nearly all the tissues.

The bark and wood showed also a distribution of tannin similar to that described in the other species, and the precipitate which it produced with ferric chloride solution was greenish black. It should be observed that in this species, in P. rigida and in P. Austriaca, the tannic precipitate had in a few of the cells a bluish black appearance under the microscope, probably owing to the presence in these cells of other bodies related to tannin, which were precipitated by the same reagent.

A COMPARISON OF THE MORE RECENT METHODS FOR THE ASSAY OF CINCHONA BARK.

By Lyman F. Kebler.

No less an authority than Dr. Fr. Hoffmann, in a review of a recent text-book of pharmacy, commented on its omissions as follows: "Among the latter (omissions) may be mentioned the desirable introduction of a chapter on the valuation or estimation of alkaloidal galenical preparations, a subject of constantly increasing importance in manufacturing and dispensing pharmacy. Although still in a state of evolution and imperfection, several methods of considerable value for the identification and estimation of drugs, as well as their fluid extracts and tinctures, have been established during recent years. The importance of the application of pharmaceutical research in this direction, and the valuation of the therapeutical constants of important plant remedies, is now of such a recognized prominence that it is one of the foremost problems in pharmacy."

In selecting a method for assaying cinchona bark, due consideration must be given to the kind of information desired. While the pharmacist does not require as elaborate a method for standardizing his preparations as the manufacturer of quinine in selecting his barks, yet he ought to be in possession of a process that yields no less accurate and satisfactory results in a comparatively short time.

The methods considered most efficient and practicable for extracting the alkaloids both from the bark and its galenical preparations may be classed as follows:

(1) The powdered bark or its preparations are macerated with ether and ammonia water, or a mixture of chloroform, ether and

ammonia water, and an aliquot part taken for analysis. Schweissinger-Sarnow,[1] Keller[2] and the author.[3]

(2) The powdered bark or its preparations are macerated with a mixture of chloroform or ether, or a mixture of both in conjunction with alcohol and ammonia water, and an aliquot part taken for analysis. Prollius,[4] De Vrij,[5] Lyons,[6] Haubensak,[7] Kürsteiner[8] and U. S. P., 1890.

The table below is given to show at a glance how closely some of the extractive solvents of the various methods approximate one another:

TABULAR VIEW OF THE AGENTS EMPLOYED IN EXTRACTING THE ALKALOIDS, ETC.

PROCESS.	Cinchona Bark.	Alcohol.	Chloroform	Ether.	NH_4OH 10 Per cent.	Amount of Menstr. Taken per Assay.	Color of Alkaloids.
U. S. P., 1890 . . .	20 gms.	152 c.c.	40 c.c.	—	8 c.c.	100 c.c.	Chocolate.
Prollius	20 gms.	20 gms.	—	170 gms.	10 c.c.	120 gms.	Chocolate.
Lyons Nos. 1 and 2[1]	20 gms.	13·8 c.c.	—	180·7 c.c.	5·5[5] c.c.	100 c.c.	No. 1 chocolate. No. 2 nearly white.
Lyons Nos. 1 and 2[2]	20 gms.	13·7 c.c.	43·9 c.c.	137 c.c.	5·4[5] c.c.	100 c.c.	No. 1 chocolate. No. 2 nearly white.
Haubensak	20 gms.	20 c.c.	—	170 c.c.	10 c.c.	100 c.c.	Nearly white.
Haubensak and Kürsteiner[3] . .	20 gms.	30 gms.	—	170 gms.	15 c.c.	100 gms.	Nearly white.
Haubensak and Keller	12 gms.	—	—	120 gms.	10 c.c.	100 gms.	Yellowish white.
Chloroform-Ether[4]	20 gms.	—	50 gms.	150 gms.	20 c.c.	100 gms.	Whiter than any other process.

[1] Prollius' mixture.

[2] Prollius' fluid modified.

[3] Moistens the drug first with 5 grammes of 12·19 per cent. hydrochloric acid.

[4] The method as used by the writer for several years and applied to the various drugs and their preparations. Mr. Keller has recently published a process for assaying cinchona bark, that approximates this one very closely. Schweiz. Wochenschr. f. Chem. u Pharm., through the Pharm. Era (1895), **15**, 78.

[5] Strong ammonia water.

[1] 1890, Pharm. Centralhalle, **31**, 771.

[2] 1892, Schweiz. Wochenschr. f. Chem. u. Pharm., **30**, 501, 509; AM. J. PHARM., **65**, 78. 1893, Ztschr. Oesterreich. Apotheker, **47**, 563, 586; AM. J. PHARM., **66**, 42.

[3] 1895, AM. J. PHARM., **67**, 499; J. Am. Chem. Soc., **17**, 822.

[4] 1881, Arch. d. Pharm, **209**, 85, 572; AM. J. PHARM., **54**, 59.

[5] 1882, Neder. Tijdschr. de Pharm., January; AM. J. Pharm., **54**, 290.

[6] 1884, Druggists' Circular, **28**, 114; Pharmaceutical Assay, §§ 13, 14, 29–36, 127, 128.

[7] 1891, Schweiz. Wochenschr. f. Pharm., **29**, 147; AM. J. PHARM., **63**, 347.

[8] 1892, Schweiz. Wochenschr. f. Chem. u. Pharm., **30**, 473; Pharm. Ztg., **37**, 750; AM. J. PHARM., **65**, 71.

The time required for the execution of the several processes varied from six to twenty-four hours, unless stubborn emulsions were encountered, as is not infrequently the case with several of the above processes.

The introduction of Prollius' method marks a new era in drug assaying. This method contains the germ from which have sprung nearly all of the most valuable methods of recent date. Prollius proposed to employ an ethereal solvent for estimating the ether-soluble alkaloids, and a chloroformic mixture for extracting the total cinchona alkaloids. It was originally designed for determining the alkaloidal value of cinchona bark, but the various modifications proposed now make it possible to apply the process to a large number of narcotic drugs and their preparations. At first, it was deemed essential to macerate the drug twenty-four hours, but experiments have proven that four hours, with a fine powder, is ample time. In this work, maceration for all methods, with the bark, was continued about four hours, with repeated agitation.

The fluid extracts were prepared as follows: Fluid extract No. I: 100 grammes of the drug were macerated three days with a menstruum composed of alcohol two parts, glycerin and water each one part; the percolation was then allowed to proceed, gradually adding of the above mixture, until 150 c.c. of the percolate were obtained. Fluid extract No. II was prepared in the same way as the above, except that the U. S. P. menstruum was employed. Fluid extract cinchona calisaya was prepared on a large scale. The fluid extracts were prepared from the respective barks assayed below.

With the processes involving the extraction of the alkaloids by means of immiscible solvents, the fluid extracts were diluted with an equal weight of water, then treated directly with the solvents for one hour, with frequent agitation, and an aliquot part taken for analysis. Fluid extracts Nos. I and II were only two-thirds normal strength, but the percent. of the alkaloids is based on a normal extract. Under these conditions the following results were obtained:

The results on the following page indicate that the methods which evaporate an aliquot part of the extractive solvent, then extract the partly dried residue with dilute sulphuric acid, and subsequently shake out the alkaloids, do not yield the full amount of the active constitu-

ents. This is, undoubtedly, due to the presence of the gummy extractive matter, which, when treated as above, agglutinates into small particles that envelope the alkaloids. These small particles being insoluble in the menstruum employed, makes it impossible to recover the alkaloids so occluded. In connection with the sulphuric acid, Dr. A. B. Lyons employs ether, which appears to facilitate the extraction somewhat.

Process.	Percent. of alkaloids in Cinchona Calisaya.				Percent. of alkaloids in Fluid Extract Cinchona Calisaya.		
	1	2	3	Average.	1	2	Average.
U. S. P., 1890	8·20	7·99	8·20	8·13	5·80	6·00	5·90
Chloroform-ether . . .	9·57	9·31	9·40	9·42	6·41	6·39	6·40

Process.	Percent. of alkaloids in Cinchona Rubra.	Percent. of alkaloids in Fluid Extract Cinchona Rubra, No. I.	Percent. of alkaloids in Fluid Extract Cinchona Rubra, No. II.
U. S. P., 1890 . .	4·57	2·43	—
Prollius	4·56	2·57	—
Lyons, No. 1[1] . .	4·79	2·49	—
Lyons, No. 2[1] . .	5·73	2·39	3·89
Lyons, No. 1[2] . .	4·97	—	—
Lyons, No. 2[2] . .	5·81	3·51	3·93
Haubensak . . .	5·96	3·43	3·97
Haubensak and Kürsteiner . .	5·90	3·59	—
Haubensak and Keller	5·27	3·61	—
Chloroform-ether	5·77	3·50	4·07

[1] Prollius' mixture. [2] Prollius' fluid, modified.

The writer has frequently treated the gummy residue with an undue amount of water, but the filtrate, when tested for alkaloids, always responded affirmatively. In view of this fact, the following experiment was made: the gummy residue was washed with water until the filtrate was only slightly acid to litmus paper; this required about 180 c.c. The filtrate was now collected in a graduated cylinder. After the first 100 c.c. were obtained, the issuing filtrate was tested by both Wagner's and Mayer's reagents; both gave

heavy precipitates. The residue was now treated with a few drops of dilute sulphuric acid, the particles disintegrated, with a stirring rod, as much as possible, and washed with water until a second 100 c.c. were obtained. The filtrate was again tested as above with the same results. The above operation was continued until 500 c.c. were obtained, testing the filtrate at intervals of 100 c.c. After 500 c.c. had passed, the filtrate still gave a turbidity with both of the above reagents. These results demonstrated to the writer that it was practically impossible to obtain all of the alkaloids by the methods embodying the above procedure.

Another difficulty inherent in these methods is the proneness of the immiscible solvents to emulsify, and the slowness of separation. This is, undoubtedly, due to the mechanical action of the particles thrown out of solution on rendering the latter alkaline. It was necessary to discard several assays in this work on account of this objectionable feature.

According to the U. S. P. process, we are to obtain 150 c.c. of the extracting menstruum, after treating the bark; but the writer's experience has been that only about 140 c.c. are obtained. The other 10 c c. are only obtainable by applying pressure to the bark on the funnel, which is objectionable, if not detrimental.

The method of Prollius yields impure alkaloids and possesses several undesirable features.

The methods that have proven quite satisfactory are those in which the immiscible extractive solvents are directly shaken out with acidulated water. Kürsteiner's modification of Haubensak's method does not appear to possess any advantage over the original process. Keller's modification of the same process must be considered of secondary importance, although very good, from the fact that Mr. Keller has published a second and better method for the same drug. After eliminating the above processes, we have left three methods that leave very little to be desired, viz.: Lyons' general process No. 2 with Prollius' mixture, Haubensak's, and the chloroform-ether processes. With the bark these methods varied from one another only 0·2 per cent., while with the fluid extracts there was even less variation. The color of the alkaloids of these methods is also very good. Those obtained by Lyons' and Haubensak's methods possess a slight chocolate color, while those obtained by the chloroform-ether process are more nearly white.

In conclusion, it is only necessary to say that, while the author favors the chloroform-ether process, he cannot consider it superior to the methods of Lyons and Haubensak to any extent.

PHILADELPHIA, January 20, 1896.

THE INFLUENCE OF CERTAIN MEDICINAL COMPOUNDS ON THE CHARACTER OF THE URINE.

BY FREDERICK W. HAUSSMANN.

The examination of urine for abnormal ingredients, in particular albumin and sugar, involves frequently questions of considerable delicacy.

To the analyst, examining insurance cases, and to the practical physician, the presence of traces of these compounds is an important matter, and it is, at times, difficult to express a decided opinion upon the normal or abnormal condition of the secretion.

Normal urine possesses the property of responding feebly to a number of reactions for glucose, and the percentage of the reducing principles, estimated by the various methods as given by different authorities, is found subject to variations. The fact that Fehling's solution is reduced and other reactions for glucose respond to a greater or less degree, by urine passed after the administration of a number of internal remedies, has only received attention in recent years, and while much remains to be learned on the subject of their elimination, in many instances we are able to foretell the occurrence of such reactions.

In the composition of such urines, we notice, however, peculiar variations.

A number will respond to every commonly employed reaction for glucose, some only to certain tests, while with the others entirely negative results will be obtained.

For instance, in urine passed after the administration of chloral hydrate, we have both the Moore-Heller reaction for glucose with alkaline hydrates, also the reducing action upon Fehling's solution, while to Boettger's bismuth test the urine will not respond.

Similar results are found in a number of instances.

The reducing power of such urines also varies considerably, some possessing this property feebly, while others reduce alkaline cupric tartrate solution readily, so that a suspicion of diabetes can be entertained, unless further inquiry is made.

To understand the reason for this action, so closely allied to glucose, it is necessary to briefly dwell upon the metamorphosis of such compounds in the human organism as far as known.

If we examine many of the remedies, after the administration of which the mentioned properties of the urine are found, it is found, in most instances, that their action upon glucose reagents is entirely negative.

Careful research has revealed the fact that compounds are formed with glycuronic acid, a substance which has many properties in common with dextrose or ordinary grape sugar. These compounds possess a number of peculiar properties, both in chemical behavior and their action upon polarized light.

In our subject, their action upon glucose reagents is of primary importance.

In normal urine, a glycuronic compound is stated to exist, the indoxyl glycuronic acid, to which some of the reducing action of the secretion is due.

Again, in the examination of glycuronic urine in general, it must be remembered, that other urine constituents also possess a similar action.

Such are uric acid, creatinin and probably other compounds, of which we possess a limited knowledge.

The reduction of these compounds takes place at a higher temperature, in some only after prolonged boiling, which property may form a point of distinction from diabetic urine.

In the following statement the writer will chiefly dwell upon such urine, which came under personal observation, adding a few data collected from different works on urine analysis.

Chloral Urine.—The peculiar action of this secretion upon glucose reagents has already been mentioned.

Chloral hydrate is rarely found as such in urine, at best only in traces, and is eliminated as urochloralic acid.

This compound turns polarized light to the left, a common property of glycuroine compounds, reduces Fehling's solution, has the same action upon indigo-sulphuric acid as glucose, but does not respond to Boettger's bismuth test. In the writer's experience the amount of chloral ingested influences the reducing power of the urine upon Fehling's solution.

Material increase of the specific gravity of the secretion does not

seem to take place, which forms a distinguishing feature from diabetic urine.

In the pale urine of a delirium tremens case, to which chloral was administered in large doses, the amount of Fehling's solution reduced by the eliminated urine corresponded to 0·4 per cent. of glucose.

In the light-colored specimen, with the specific gravity of 1·022, of a patient who had taken 60 grains of the drug, administered within two days, the amount of reduction corresponded to about 0·15 per cent.

This case was kept under observation, the urine being examined before and after the ingestion of chloral.

The reduction took place only during the administration of the drug.

A singular fact is that in chloral urine the Braun-Johnson picric acid and potash test do not react. This, together with the non-action of the bismuth test, is remarkable.

Croton Chloral Urine.—Regarding butyl chloral urine, conflicting statements are found.

According to some writers, it will reduce Fehling's solution, while according to Neubauer and Vogel, butylchloralic acid, under which form the drug is eliminated, possesses no reducing action upon cupric or other metallic oxides in alkaline solutions.

In one sample examined by the writer, the reducing action found was slight, by no means as prominent as in the case of chloral urine.

Chloroform Urine.—In connection with chloral urine, it may incidentally be mentioned that urine containing chloroform will also reduce Fehling's solution.

The distillate from a specimen of this kind reduces ammoniacal silver nitrate solution, while in the distillate from urine containing acetone, no such action takes place with either reagent.

Turpentine Urine.—The urine voided after the administration of oil of turpentine has repeatedly been the subject of investigation. The peculiar odor communicated to the secretion by this drug has been described as resembling that of violets, although the original terebinthinate odor is frequently noticeable, especially upon the addition of mineral acids.

In examining turpentine urine for abnormal ingredients, a knowledge of the physiological action of the oil is important.

Albumin Reactions.—Turpentine urine is not infrequently found to respond readily to albumin tests.

This may be due to a temporary albuminuria produced by the drug, the latter possessing the property of causing strangury and occasionally bloody urine.

In such cases the presence of albumin is transient, disappearing with the suspension of the drug.

Again, so-called resin acids make their appearance in the urine after the ingestion of turpentine, also manifesting themselves upon the application of certain tests for albumin.

The amount of albumin found in such urine varies apparently with the amount of the medicine administered; but it is in some instances surprising what little turpentine will produce a temporary albuminuria. Other factors, which are liable to cause nephritic disturbances, independent of the action of the oil, must, however, also be considered, such as febrile albuminuria or incipient Bright's disease.

A special examination was made in a case where opportunity was offered to study the effect of the drug upon the urinary secretion.

The urine of the patient, before the administration of turpentine oil, had a normal specific gravity, and bore no evidence of either albumin or sugar.

Six drams of the oil were administered in forty-eight hours, at the end of which a specimen of the urine was examined. The same had an acid reaction, the characteristic odor, a brown-red color, and a specific gravity of 1·032.

The examination for albumin gave the following result: Albumin was found by the heat test, nitric acid and picric acid contact methods, acetic acid and potassium ferrocyanide reaction, Tanret's test, and with concentrated magnesium sulphate in the presence of acids (Roberts' test).

Three days after stopping the medicine, the urine was again examined, the physical properties being nearly the same, the specific gravity, however, only 1·025. Traces of albumin were still found, but the reactions were more feeble.

Similar results were also obtained in the examination of other specimens of turpentine urine.

The resin acids mentioned may coexist with the albuminuria, and, upon the application of reagents, may also be precipitated.

Their difference from albumin is shown by their solubility in alcohol.

Physical Properties.—The color of turpentine urine is usually deep red, independent of the fact that blood may be present. The color continues some time after ceasing the administration of the oil.

The specific gravity, in the writer's experience, is increased, the increase continuing for some time. The reaction is, in most cases, strongly acid.

Sugar Reactions.—Turpentine urine will also respond to the commonly employed reactions for grape sugar.

This is due to terpenglycuronic acid, which has the property of reducing Fehling's solution.

The high specific gravity of such a urine specimen may have the tendency to suspect a diabetic condition, although the red color of turpentine urine differs from the one of diabetes.

The amount of oil of turpentine ingested apparently influences the reducing power of the urine.

For instance, in the specimen mentioned above, the amount of Fehling's solution reduced corresponded to a glucose percentage of 0·5, while in a case where 240 minims of oil of turpentine were administered in two to three days, the amount corresponded to 0·25 per cent. of glucose.

In the former specimen, after the medicine was stopped for 4 days, the amount of reduction corresponded to a glucose percentage only of ·1 per cent.

Marked diminution in the specific gravity also took place in this instance.

Other Glucose Tests.—Besides reducing Fehling's solution and responding to Trommer's test, turpentine urine will also give decided glucose reactions with Boettger's and Nylander's bismuth tests and the Braun-Johnson's picric acid and caustic alkali method.

The bismuth tests respond with the same rapidity as a grape sugar solution, while the deep mahogany color of the picramine test of Braun was readily developed on boiling.

It may be stated that the two tests mentioned last cannot be relied upon in most glycuronic urines. Examination of the different specimens of turpentine urine, after removing the reducing glycuronic compound by means of basic lead acetate, showed the same to be perfectly free from glucose.

Incidentally, it may be mentioned that pure oil of turpentine, examined with various glucose reagents, showed no reducing power whatever.

Other Remedies.—In connection with the foregoing, it may be stated that a number of other remedies produce similar reactions when eliminated by the kidneys.

Copaiba and its oil behave similarly to oil of turpentine when being examined for albumin.

When examined for the latter, the urine may reveal the presence of resin acids, and the same means, their solubility in alcohol, will furnish the point of distinction.

Incidentally, it may be mentioned that, after the administration of a large dose of cubeb and its preparations, an identical result is said to take place.

It may likewise be surmised that many remedies of a balsamic nature are liable to produce this effect.

Copaiba urine will also reduce Fehling's solution, but, according to Quincke, will not affect the bismuth tests. It is readily distinguished by its characteristic odor and the red or purplish color it develops when mixed with hydrochloric or other concentrated acids.

The numerous synthetical organic compounds, introduced into medicine within the last few years, furnish a large field for research in urine analysis.

The elimination of a number in the urine as glycuronic compounds has been studied, but many require further investigation.

They possess the peculiarities referred to in their action upon polarized light, being all lævogyre, as well as the reducing action upon glucose reagents.

Some, however, do not reduce the mentioned test liquids. Such are phenolglycuronic and camphoglycuronic acid, eliminated after the administration of carbolic acid and camphor, and the compounds formed after the ingestion of antipyrine and other remedies.

Among a number which exert a reducing action, a few deserve prominent mention.

Such are acetanilid or antifebrin, kairin, morphine, nitrobenzol and bitter almond oil, benzoic and salicylic acids, and their respective salts, together with others of more or less importance.

Acetanilid Urine.—This deserves, perhaps, more than passing notice. Urine passed after the administration of this compound readily reduces Fehling's solution and responds to most other sugar tests.

It is usually of a red color and increased specific gravity.

To physicians such urine is of considerable interest, also to the insurance analyst, if it is considered to what extent the drug is consumed in the form of the many popular headache and neuralgia remedies.

The popular effervescent headache cures, to the baneful influence of which many are addicted, will furnish us with this source of error, as well as the nostrums, principally composed of acetanilid, which enjoy the patronage of many physicians.

Acetanilid is eliminated in the urine as para amido phenol glycuronic acid.

According to Le Nobel, Nylander's bismuth test, to which acetanilid urine responds, reacts in a similar manner to glucose also with urine passed after the administration of kairin, tincture of eucalyptus and large doses of quinine, giving a black precipitate.

Chrysophanic Acid Urine.—Another urine, which cannot be strictly classed with the glycuronic, although it possesses a number of their properties, is chrysophanic acid urine, eliminated after the administration of rhubarb and senna.

This has been considerably treated upon recently, and a number of methods have been proposed to detect this principle in urine.

The statement has been made, by some writers, that such urine possesses the property of reducing alkaline copper tartrate and alkaline bismuth solutions.

Physical Properties.—Chrysophanic urine is of a yellow, sometimes greenish-yellow color, gradually turning darker as the urine undergoes decomposition.

It is characterized by the red color developed with alkalies, although the urine eliminated after the administration of santonin is said to possess the same property. The red color thus produced is again changed to yellow by the subsequent addition of acids.

Outside of its similarity in color, chrysophanic urine possesses none of the characters of urine containing bile, or, perhaps, only when the precipitation method by means of alkaline earth bases is employed, when, however, other distinguishing features prevail.

Comparison with Glucose Tests.—It is questionable whether the so-called reduction of copper tartrate or alkaline bismuth solution, by means of chrysophanic acid urine, is due to the inherent property of this principle.

Such urine, no doubt, has the property of slightly reducing Fehling's solution, but the reduction is probably due to other urine constituents, perhaps glycuronic compounds.

Even chrysophanic acid, extracted from rhubarb, has a feeble reducing power upon alkaline cupric tartrate solution.

To determine this point, the writer prepared chrysophanic acid from rhubarb, subjected it to the commonly employed sugar reagents, and compared with the substance commercially known as chrysophanic acid, the chrysarobinum of the Pharmacopœia.

The following differences were noticed:

The acid prepared from rhubarb in a saturated aqueous solution gave, with alkalies, a purple color, while a similarly treated chrysarobin solution became deep red.

The reducing action of the former upon Fehling's solution was extremely slight, while with the latter, precipitation of red cuprous oxide took place.

In the rhubarb acid, the blue of the copper solution was turned purple, with chrysarobin a red color.

Several other differing points were also observed.

In the examination of chrysophanic urine, in view of the action of alkalies upon this principle, the important fact must be considered that, with few exceptions, all tests employed for the detection of glucose take place in alkaline media.

It is therefore likely that the action of alkalies upon chrysophanic acid, namely the red coloration, may take place in such urine.

As many glucose tests are based on similar color reactions, this may prove a source of error in examining for small quantities of glucose.

The writer subjected various samples of chrysophanic urine, both natural and artificially prepared, to a number of sugar tests to study their effect.

(1) Moore-Heller test (heating with alkaline hydrate solutions).—Purplish red color, differing from the brown produced in the presence of grape sugar.

(2) Rubner's or O. Schmidt's test.—This consists in treating the urine with lead acetate solution, filtering and treating the filtrate with ammonia.

A white precipitate of lead saccharate is formed, which, if glucose is present, will assume a flesh or red color on boiling.

Thus employed, this test will not be affected by chrysophanic acid urine, as the lead salt will precipitate the latter. But if the following modification is employed, a different result may take place:

Three grammes of lead acetate are dissolved in 10 c.c. of urine, by heat, filtered and the still hot filtrate treated with ammonia.

On heating the mixture to boiling, the above-mentioned color will be developed in the presence of glucose.

In following this method with chrysophanic acid urine, part of the acid does not seem to be completely precipitated and to pass into solution, when, upon the addition of ammonia, also a red color will be produced, as in the case of glucose.

Some care is, therefore, necessary in employing this test.

(3) Reaction with copper solutions.—The usual method for the examination of urine for sugar consists in observing the action upon boiling diluted Fehling's solution.

If chrysophanic acid urine is added in this manner, the blue of the alkaline copper solution is turned to a reddish-brown, occasionally a purple color.

The usual reaction is the following:

Upon first addition of the urine, the blue color is changed to purple, gradually turning reddish-brown upon the further addition of the urine.

The amount of the principle present influences the reaction to a considerable degree, however.

(4) The bismuth tests.—Boettger's and Nylander's alkaline bismuth tests, when applied to chrysophanic urine, respond in a manner somewhat similar to glucose.

On boiling such urine with the alkaline bismuth mixture of Boettger, it assumes a purple color, while the precipitated bismuth salt will be blackish-gray.

A similar result takes place, according to Salkowski, in Nylander's modification, a blue-black precipitate being formed.

(5) Sachse's solution is used for the quantitative estimation of glucose.

It consists of solution of potassium iodohydrargyrate, with a considerable excess of alkali.

The solution is reduced to metallic mercury in the presence of glucose.

For a reliable sugar test in urine it is not adapted, as this secretion is liable to reduce it when glucose is absent. In chrysophanic urines this result takes place readily, the supernatant urine, after the precipitation of mercury, possessing a red-brown color.

It resembles, in this respect, diabetic urine; due to the large excess of alkali in Sachse's solution, the sugar is sometimes caramelized, and the mixture will have a brown color.

The same results may be expected in Knapp's alkaline mercuric cyanide solution.

(6) The picric acid and potash method of Braun and Johnson is also liable to produce a dark color, as with glucose, when applied to chrysophanic urine, due to the action of the alkali upon the acid.

In this test, however, no dark red color is produced, unless the other reducing constituents of urine are factors also. The yellow picric acid evidently retards the formation of the deep mahogany color produced in the case of glucose. But if the urine be rich in chrysophanic acid, the alkaline mixture will also turn quite dark on boiling.

Several other tests are open to the same objection, namely, the action of the alkali upon chrysophanic acid, when applied to such urine.

This may be the case, for instance, in Penzoldt's diazobenzolsulphonic acid reaction in the presence of strong alkali, the purple color produced by the latter in chrysophanic urine being liable to be mistaken for the red-blue tint produced in diabetic urine.

Source of Error in Diabetic Urine.—We have, so far, considered the liability of chrysophanic urine to be a source of error in examining healthy urine for small amounts of glucose.

But it can also interfere in diabetic urine, and, in some cases, retard the accuracy of certain tests.

In such cases it must be supposed that rhubarb or similar medicines have been administered to a diabetic patient, or one slightly suffering from glycosuria.

Some of the recently introduced tests for glucose, also acting in alkaline media, depend upon decolorization of the test liquid, the glucose present acting as reducing agent. One of these tests is Crissler's reaction with safranine. This is, for ordinary purposes, an excellent reaction, where an accurate quantitative estimation of

glucose is not desired. This test is applied, according to Allen, as follows: Equal measures of urine (2 c.c.) of normal KOH or NaOH solution, and a solution of safranine, 1 part in 1,000 parts of water, are mixed.

The mixture is heated in a test tube, avoiding agitation as much as possible, till freely boiling.

If the urine contains more than 0·1 per cent., the liquid is decolorized; otherwise, the red color remains intact, or is only partially discharged.

If the color is destroyed, the test may be repeated with twice or three times the volume of the safranine solution, which represents roughly 0·1 per cent. of sugar.

If more than four or five measures are required, the urine is diabetic.

If this test is applied to a chrysophanic urine, containing a small percentage of glucose, complete decolorization of the mixture does not take place, due to the action of the alkaline excess upon the chrysophanic acid.

The urine must, however, contain a considerable amount of the latter, or else no material difference is noticeable.

In specimens rich therein, this interfering action can be plainly observed.

Another test, dependent upon decolorization, is based upon the fact that potassium ferricyanide, commonly known as red prussiate of potash, in alkaline solution, is changed to ferrocyanide in the presence of glucose.

It has, however, been shown that uric acid also has the same effect.

To this may be added that, in chrysophanic urine, possibly containing sugar, no such decolorization takes place.

The excess of alkali will color such urine red, which is not destroyed, even upon the subsequent addition of glucose.

The reliability of this reaction as a sugar test is, therefore, open to criticism.

Chrysophanic urine is stated to be eliminated after the administration of rhubarb and senna.

Even the external application of chrysarobin, according to Rosenthal, is stated to produce it in the urine.

In the experience of the writer, after the administration of large

doses of cascara sagrada, urine is eliminated, which has properties similar to chrysophanic urine, although apparently to a less degree than that produced by rhubarb.

After large doses of aloes, the urine sometimes turns darker upon the addition of alkalies, and it was found not to be due to glucose.

Perhaps similar reactions to those described may be obtained with principles which pass through the kidney and give color reactions with alkalies.

As previously mentioned, santonin is stated to possess this property, but to what extent it may influence the reagents mentioned, the writer is unable to state, as, so far, he has been unable to procure a specimen of santonin urine.

Separation of Chrysophanic Acid.—It may be desirable to remove the interfering chrysophanic acid for the further examination of such urine samples. This is best effected by precipitation with basic acetate of lead solution, which, besides the acid, removes also glycuronic compounds.

Subsequent removal of the excess of lead by means of sulphuric acid, and subsequent examination in the usual manner for glucose, becomes necessary.

Animal charcoal will also remove chrysophanic acid from urine.

In presenting this paper to the meeting, the writer is conscious of the fact that many of the points briefly dwelled upon are deserving of more exhaustive treatment. The object has been to call attention to an important matter, which offers a field for interesting research, and of which our knowledge at present is at best limited. The pharmacist can aid scientific investigation in physiological chemistry by a careful scrutiny of different prescriptions, and considering the probable elimination of the prescribed drugs.

By calling the attention of physicians, who can procure samples of urine more readily than the pharmacist, to the importance of this matter, interest can be created and much valuable information can be obtained.

If this receives careful attention and study, a systematic treatise upon the elimination of drugs can be expected in a short time.

KOLA AND KOLANIN.[1]

By Fred. B. Kilmer.

Those who can realize the thoughts of the coal-carrier who went to Newcastle, or him of Shakespeare who gilded gold dollars, colored flowers of the fields, sandpapered ice, and threw the reflection of a candle against the noon-day sun, can imagine the feelings with which I have accepted the call of your committee to read a paper before this body of pharmacal savants. In this noble institution of American pharmacy, the lower-class men can attain a knowledge never reached even in the professor's chair in the school of many of us. For one denied these great privileges to attempt the discussion of a phyto-chemical subject before the faculty of this College, seems highly presumptuous. To be given a topic that has been so ably handled in your journals, in the professors' chairs, and in these meetings, smacks of ridiculous excess. I shall, therefore, at the outset, state that I have come to seek rather than to give information; to ask questions rather than to attempt to anwser them, conceding to my auditors an ability and familiarity with the subject far greater in most respects than my own. We may note here, in retaliation against the ill-timed jests as to the slowness of Philadelphia, that the first scientific reference in this country, to the kola plant, upon which I am to speak, may be found in the American Journal of Pharmacy, in 1865; that the first medical report in America upon its action was published in the Philadelphia *Medical Times*, in 1886. The first full clinical report was from the pen of Dr. Shoemaker, of Philadelphia.

The subject assigned me is the well-worn theme, the Kola Plant. Its history and pharmacognosy are so familiar that we can safely pass them, except to call attention to the botanical specimen of a flowering branch, specimens of the pods, the nuts, photographs taken in the habitat of the drug, together with samples of the dried and undried fruit, all of which I present to your Museum. The kola nuts, as found in our market, come mainly from Africa. The bulk of the West India nuts are consumed by the inhabitants of the islands; a very small part of the crop is shipped to Europe, commanding there a higher price than the African nuts. Lately, small supplies have reached our market from this source. No accurate estimate of

[1] Read before the pharmaceutical meeting of the Philadelphia College of Pharmacy, January 21, 1896

the extent of the world's supply, nor the possible yield for this drug, can be given. The official reports of the African trade give from 2,500,000 to 3,000,000 pounds per year, which is mainly utilized for home consumption. Those who are familiar with tropical products can realize the difficulties and peculiarities of the market in such a commodity. It is carried on mainly through native women. There is a certain amount gathered for home demand. The quantity that will reach the shipping ports must depend upon the caprice of the natives, and especially as to how much they stand in need of rum or tobacco. The crop must all be carried, often hundreds of miles, in head loads, through miasmatic forests, over impassable streams, across pathless mountains, under a tropical sun. The conditions are such that, to gather a ton of nuts and safely land them on a ship that plies along Africa's sunny shores, is a task that one would shrink from after a survey of the field. The native gatherers are shrewd dealers, even if not well skilled in the arts of civilized commerce. They know how to corner supplies, to create a rise in price, and they also know that, when a European buyer wants the nuts badly, grades that have no value at home will find a ready market. This accounts, in part, for the quite variable nature of market specimens. In the West Indies, the governments encourage the cultivation of the plant, and, before many years, ample supplies from this source will be obtainable. In our own country, some attention and discussion has taken place, looking towards its cultivation on our soil. Therefore, the following notes, gathered from observation and from the notes taken in the Botanical Departments of the West India Islands, may be of interest:

NOTES ON THE CULTIVATION OF KOLA.

The kola plant seems to grow well in any climate where there is plenty of rainfall and a warm, tropical sun. Of course, the hotter and more moist the climate, the better. Wherever bananas, nutmegs or cacao will grow, it is safe to say that this tree will thrive. The best kind of soil is that which is deep, rich and clayey, although it will grow in a great variety of soils. In some of the West India Islands, it may be found as high as 5,000 feet above the sea level, but the best specimens are generally found at not over 1,000 feet elevation. If the situation is low and damp, the ground must be well drained. The young plants may be obtained directly from the

seed, planted in the field where they are to grow; but the best results seem to come from planting the seeds in nursery beds, transplanting them when plants are from 2 to 3 feet in height. The seeds as usually obtained from growers are packed for shipment in boxes covered with earth, and the whole wet with fresh water. Holes are bored in the boxes for ventilation. The nursery beds in which they are planted are made of loam, peat or leaf mould and kept shaded. In nursery planting the seeds are put in the bamboo pots commonly used in the tropics, and placed from 9 to 12 inches apart. It takes three to five weeks before the sprouts appear above ground. When ready for transplanting they are set a distance of about 25 feet apart. If the soil into which they are transplanted is not rich, the best planters dig holes several feet deep, 5 feet each way around, and fill in with the topsoil. It is necessary for the young plant to have shade. Many intelligent planters, who have lately taken up the planting of kola, use the banana for the purpose. The banana is a very rapid-growing tree. It shelters the young kola plant and makes a profitable crop while the kola is coming into bearing; kola, in turn, will begin to yield by the time the banana has exhausted the soil. The bananas are planted 10, 11 or 12 feet apart, with the kola at every second banana in the direction of the line. Thus, a plot of 20 feet square is enclosed with banana trees with four kola plants at the corners, leaving the kola from 20 to 24 feet apart. In sheltered situations, as in a low valley between hills that have a growth of woods, the banana is omitted in the centre of the square, to give more light and air. The gradual thinning out of the banana is made as the kola acquires increased growth. Kola is usually planted at the beginning of the wet season. Grown wild, it commences to yield fruit about the fifth or sixth year. Well-cultivated specimens often begin to bear considerably earlier. In the wild state they reach full bearing in the ninth or tenth year. When the kola tree attains full size, it is customary with planters to place in the field with them small varieties of coffee, or some vegetable plants such as peas or yam. Kola gives the necessary shade. The stems and leaves of the other plants furnish a good fertilizer. By this method a kola plantation costs nothing except for the first planting. Kola does not appear to exhaust the soil as does the coffee, banana, orange, etc. Upon once attaining its growth it appears to be of permanent value. Specimens that have borne for fifty years and probably

longer have been noted. Independent of its value for the nuts, kola is an excellent shade and timber tree, and is utilized for this purpose. A conservative estimate of the yield is 120 pounds of dried nuts, or over 250 pounds of green nuts per tree, or from 8,000 to 10,000 pounds per acre. No such amounts, however, are gathered in any portion of the West India Islands owing to the unsystematic and haphazard measures employed in harvesting the crop.

THE PODS AND SEEDS.

Taking up that part of the plant probably of the greatest interest, the seeds or nuts, we may examine the pods, which we will find contain from two to twelve nuts or seeds, so closely pressed together in growing as to be crowded into various shapes. The cellular tissue of the pod before drying is filled with a very slimy, stringy mucilage that is largely absorbed upon ripening. A singular fact noticed about the seeds is the fact that red and white nuts are found side by side in the same pod. So far as my observation goes, pods may be found that contain all red or all white, but no trees give all white or all red seeds. The native users lay great stress upon the difference between the white and red kola nuts. Symbolically, the white nuts mean peace, happiness, veneration, acquiescence to overtures. The red nuts mean the reverse: war, ill-will, challenge, rejection of overtures, etc. In some instances the white seeds command the higher price, being in repute as giving greater and better effects. In the dried nuts found in our market it is difficult to distinguish between the white and red variety. Oxidation during the drying of the seeds gives to both about the same yellow-brown color. When subjected to the action of solvents, white or red nuts (dried) yield to water, alcohol, acetone or glacial acetic acid, shades of orange and yellow which are slightly deeper with the red than with the white variety, but so nearly alike that considerable practice is necessary to distinguish between them. The coloring matter of the red nuts is, however, very soluble in dilute mineral acids. The white and red varieties may be distinguished by macerating for twenty-four hours in dilute sulphuric or hydrochloric acid, when it will be found that the acid extraction of the red kola is a beautiful red rose, while that of the white seeds is of a light straw color. Heckel has shown that if the acid extraction is made alkaline with ammonia, that from red nuts assumes a purplish violet; that from white an ochre-like color.

Several observers have noted that the red nuts give a larger percentage of moisture (Heckel gives 46 per cent. for white, 56 per cent. for red). The same author claims that the white seeds contain 5 per cent. more caffeine, 7 per cent. more of the peculiar principle, kolanin, than the red. My own experiments tend to confirm the observation that there is an appreciable difference in the amount of glucoside found in the white seed as against that found in the red.

ALKALOIDS.

The alkaloids so far identified as belonging to this plant are such familiar substances that any comment upon them is unnecessary. Worthy of note, however, is the fact of their close relationship to each other in chemical formula and structure. Also, that they are analogous and apparently identical with the alkaloids found in all the caffeic group of plants; that they are closely related chemically and physiologically with the xanthine bodies, which are found normally in the muscular and other tissues, such as the liver, spleen, brain substances, etc., of the animal body. These xanthine bodies are typical products of the downward destructive metabolism of proteids. Similarly, the alkaloids of this plant seem to form when the seed is on its way toward removal from the tree.

Xanthine $C_5H_4N_4O_2$.
Para-xanthine $C_7H_8N_4O_2$.
(Dimethyl-xanthine.)
Theobromine $C_7H_8N_4O_2$.
(Dimethyl-xanthine.)
Caffeine $C_8H_{10}N_4O_2$.
(Trimethyl-xanthine.)

Caffeine, as theine, was roughly identified as present in these nuts by Dr. Daniells, and confirmed by Attfield, in 1865, who gave the percentage in the samples examined as 2·13. The second alkaloid, theobromine present in quite small quantities, was separated later. Numerous assays of the drug show greatly varying amounts of these alkaloids. A quite recent assay of the carefully prepared powder is as follows:

ASSAY OF SAMPLE OF DRIED KOLA, BY WENTWORTH LASCELLES SCOTT, CHEMICAL AND MICROSCOPICAL ANALYST, LONDON.

Calculated upon the Substance Free from Hygroscopic Moisture.

Caffeine (or theine)	3·202
Theobromine	·214
Other alkaloids	·065
Kola red and kola orange	3·874
Fatty matter	1·142
Ash	3·955

The experiments made by the writer in the habitat of the plant seem to show that these alkaloids are found chiefly in the ripe or nearly ripe seeds (except that, in a very few instances, the pods have given faint alkaloidal reaction). The wood, bark and leaves give entirely negative results. Experiments are now being made to determine more accurately at just what stage in the life history of the plant these bodies are first manifest. In the limited number of experiments made, the results indicate that, in the green nuts, only traces of the free alkaloids are present, and that the quantity increases materially as the nuts ripen.

KOLANIN.

Heckel and Schlagdenhauffen have set us an illustrious example in the study of drugs by devoting twelve years to the investigation of this plant. Very early in their researches, after exhausting the alkaloids, they separated a body which seemed to them to present an analogy to cinchona red. They found it to contain an active principle which they were at first unable to separate, but which they found to be capable of giving striking physiological results.

Ernst Knebel, of Steeg, in 1891, also a notable name in the history of this drug, in a long and laborious examination, demonstrated that a glucosidal body was present, to which he gave the name kolanin. In his essay he gives several methods of separation, one of which is as follows: The powdered kola is first extracted with alcohol, the extract evaporated to dryness, the finely ground extract then exhausted with chloroform. When the residue is found freed from caffeine, it is mixed with clean sand, washed in cold water until the washings run off slightly colored. (This washing is to remove glucose, tannin and salts.) The washed residue is dissolved in alcohol, filtered, and again evaporated. The product is substantially the *kola rouge* of Heckel. Knebel demonstrated that this glucoside upon decomposition, gave caffeine, glucose and a third non-nitrogenous body (Knebel's *kola roth*). We should, therefore, remember that Knebel's kola red is a non-nitrogenous body, which, he stated, is joined in chemical union with caffeine as a component part of the glucoside kolanin. Real *kola roth*, as Knebel terms it, is a decomposition product of the glucoside. He shows that it is closely related to the tannins, containing the same number of hydroxyl groups, and giving, upon fusion with caustic potash, pyrocatechin,

formic, acetic and isobutyric acids. He believes this substance is converted into tannic acid during the drying of the nuts. The work of both Heckel and Knebel heretofore referred to upon kolanin was conducted mainly upon the dried drug. It is quite evident, however, from the results obtained by a number of other observers, that, in the undried seed, especially before ripening, little or no caffeine exists as a free alkaloid. In carefully manipulated samples of the unripe nut, the quantity in some instances has been found to be quite small, especially when the nuts are fresh from the tree. It has, so far, been found difficult to separate kolanin free from fat, resinous and extractive matter; the tannin and mineral constituents present in small amounts are also more or less difficult of removal. The glucosidal body itself is also given to decomposition in the manipulations used for removal. Therefore, it may not be strictly correct to say the end product is absolute kolanin.[1]

In the process given by Knebel for the separation of kolanin, even the washing with water causes some change in the glucoside. The kola rouge of Heckel and Schlagdenhauffen is really an impure glucoside, contaminated with glucose, tannin, inorganic salts and some fatty bodies. For their product these authors have given the following properties and reactions: Freed from glucose and fixed salts by precipitation with acetate of lead and sulphuretted hydrogen, it gives a deep green color with iron salts. Ammoniated citrate of iron, with an excess of ammonia, gives a blood-red coloration. Tartarized antimony gives a voluminous precipitate; gelatin, a white precipitate. A solution of nitrate of silver is reduced. The product itself is a brown-red, amorphous, bitter powder, insoluble in cold water, partly soluble in boiling water, in hot water forming a resinous, greasy ball, cooling to a shiny, hard mass. When freed from tannin its solution gives a brown precipitate with alum, with sulphate of copper a dark green precipitate. A precipitate is formed with a solution of iodine in potassium iodide. A more purified form of kolanin is soluble in boiling water, alcoholic solution of

[1] I am also of the opinion that in the processes in common use for the assay of kola, kolanin is not entirely broken up, and, therefore, the whole of the alkaloidal content of the drug is not revealed in the result. Prof. A. R. L. Dohme is of the opinion, however, that, in the process outlined by him at one of these meetings, the glucoside is entirely decomposed. I have suggested to him that he continue his investigations, and have sent him samples of both the dried and undried drug for the purpose.

potassium hydrate and ammonia. Its alkaline solution is red-brown when cold, but becomes red on warming. Its alcohol solutions do not act upon salts of iron, but are precipitated by plumbic acetate. Upon sublimation, this product gives out an empyreumatic oil and traces of caffeine. Upon boiling with dilute hydrochloric acid it is not dissolved, but partly decomposed into glucose and caffeine. As above noted, it is partly broken up by continued boiling in water, and completely by boiling in a dilute sulphuric acid, 20 per cent. strength. Knebel, in his article, demonstrates that the glucoside, kept at a temperature of 60°–70° C. for twenty-four hours, is decomposed into its components, viz.: caffeine, glucose and a third product, non-nitrogenous coloring matter, which he names *kola roth.* In his work he demonstrates the molecular proportions of these constituents. Kolanin is also decomposed by the action of the ferment of the kola, kolazym by the action of the ferments of the saliva and of the gastric juice.

The crude method pursued by the writer in the habitat when working upon the undried nuts was to extract the finely chopped nuts with ether, allow the ether to partly evaporate, then extract both the nut and ethereal residue with chloroform. In the chloroform extraction the caffeine was to be found, in the ethereal solution of the glucoside. This process was first devised as a field expedient, where the laboratory was carried on a mule's back. Its use was afterwards verified in the home laboratory. In practice it was found that ether extracted the water and the glucoside and some caffeine, but left behind some alkaloid; hence, the farther extraction with chloroform was necessary. It was also found that, if the nuts were chopped under ether, alcohol or other liquid, without allowing exposure to air and drying, only a faint reaction for alkaloid would result; whereas, if the nuts were broken open and allowed to dry or partly dry, quite a crop of crystals could be separated. In subsequent experiments it was found that all manipulations which involved the use of heat—such as allowing the nuts to partly or fully dry—cutting them open resulted in quite an increase of alkaloid crystals; also that, when great care was used, with little exposure to air, the avoidance of heat in all stages of the process, the amount of alkaloid was apparently much less. This was afterward confirmed when, in attempting to separate the glucoside, it was found that processes involving heat and exposure to air provoked the breaking up of the glucoside.

From the processes outlined by both Heckel and Knebel, we can readily see that several methods of operation will give the body termed kolanin. For instance, if a solid extract (or an evaporated fluid) be exhausted of caffeine by the aid of chloroform, then washed with cold water to remove such extractive matters as may be soluble, there will remain the kolanin in an impure state. If, in his process, after the exhaustion of the extract with chloroform, the residue is extracted with ether, the kolanin, in a somewhat pure state, will be taken up in the ether, and may be separated by evaporation. After the chloroform is exhausted, I have found it good practice to wash first with petroleum ether to remove some fatty bodies not removed by chloroform, then to follow with the ether extraction. If, in all these operations the solvents and washing liquids are kept faintly acid, there is, seemingly, less decomposition of the glucoside and formation of the tannic-like matters.

FERMENTS.

It has been proven that there is present in this nut an unorganized ferment, to which the name kolazym has been applied. This body appears to possess manifold powers (possibly there is more than one ferment present). Kolazym is a glucosidal enzyme, having the power to split up the glucoside kolanin into glucose, caffeine, and a tannin-like body. It is also a carbohydrate enzyme, giving quite active diastasic action upon starch. It seems to be active in faintly acid solutions, but will act in neutral and feebly alkaline media, acting best at a temperature of about 54° to 65° C. Extreme cold, as well as boiling, seems to destroy its powers. It may be quite readily separated from the undried nuts by macerating the chopped tissue in glycerin and water, made faintly acid, then pouring the glycerin extraction upon dilute alcohol. A fine, cloudy precipitate of proteid matter will be thrown out of the solution, carrying with it the ferment. The precipitate may be further purified by redissolving in water and glycerin, and reprecipitation as before, with final washing in absolute alcohol. Its most active state seems to be in this freshly precipitated and moist condition. Drying over calcium chloride or sulphuric acid seems to inhibit it. Drying by heat almost wholly destroys its power. The separated ferment will convert soluble starch into dextrine bodies and sugar. It will decompose kolanin into its constituents, glucose, caffeine and kola red.

The exact nature and office of plant ferments are somewhat obscure. Prof. J. R. Greene, London, gives as an explanation the fact that, in constructive processes of plant life, an excess of material is formed over and above that immediately utilized; that this excess is temporarily deposited in the tissues, nutritive material of various kinds being found in different regions of the plant. When the constructive process is at rest the action of the ferment is called forth, and the reserve food is made ready for assimilation by a process of digestion, in which the ferments are active factors. Under this view, kolazym may be said to act upon the reserve food stored in the seed. During the resting stage of the seed, it starts the digestion of food for the future plant. In the kola nut, some of the products of this metabolism are the alkaloids caffeine and theobromine; similarly, a product of the metabolism of meat are the closely related xanthine bodies. We find in the ripened seed glucose, which shows the ferment has been at work. It has been stated that in the germinating stage more caffeine is present than when the seeds were first taken from the tree. Prof. Greene claims that the glucoside bodies and their ferments which act upon them are deposited in different cells.

PHARMACOLOGICAL NOTES.

An apology may be due from the pharmacist when he enters the domain of pharmacology, but in my judgment the work of the pharmacist does not end with his chemical assay. To verify or nullify his conclusions, the action of any drug in question upon animal economy must be determined (quite apart and distinct from their action in disease). Under our present methods of drug investigation, this work is left largely in the hands of the medical practitioners, but, of necessity, does not belong there. Not all practitioners of medicine are fully competent to reach proper conclusions in this field, and those who are competent are too busy to carry out any extended researches. If all that were known about the host of new and old drugs was expressed in a table of their chemical constituents, what information would this knowledge convey as to their value in medicine? If kola were an entirely new drug; if its alkaloids, caffeine and theobromine, its glucoside kolanin, were entirely known, should the pharmacist be content to rest on its assay and say to the physician, I find in this drug one glucosidal body and two free alkaloids; the alkaloids are so similar, chemically, that it is

difficult to tell them apart, but here's the value of this drug expressed in chemical symbols? Is this all that pharmacy can do for medicine? Before a drug can be given a place in therapeutics, somebody must first accurately determine its physiological action. The proper value of a drug in medicine will largely depend upon the exhibition of its constituents in their most active condition. The pharmacist must know the physiological action as well as the chemical nature, else how can he make an eligible preparation? The study of any drug is pharmaceutically incomplete until this is done, and without such a study medicine cannot apply it in therapeutics. It seems to me, therefore, pharmacology lies well within the domain of pharmaceutical chemistry. Modern science teaches us that drugs having differing chemical affinities differ in their effects upon the body, while those belonging to the same chemical groups are allied in their action. By altering their chemical composition the place of their action and effect is changed. The chemical constitution of a substance has an important bearing upon the part of the organism which it will affect, so that, in the evolution of science and the application of drugs, medicine must invade pharmaceutical chemistry, or else pharmacy must absorb pharmacology. We may rightly abhor and eschew counter prescribing and pharmaceutical therapeutics, but it seems reasonable that the study of the action of drugs apart from their therapy is a fitting field for the pharmacist. With these thoughts, let us briefly review the pharmacology of the drug before us. By chemical assay we have separated two alkaloids, caffeine and theobromine. As found in the plant, they are so closely combined as to be difficult of separation. Physiologically, their action seems to materially differ from a simple mixture of the same two alkaloids in equivalent proportions. From a chemical point of view we have expressed the value of this drug on its alkaloidal contents, irrespective of all other constituents. Is this the correct and the total value? Is morphine the full measure of the value of opium, cocaine of coca, quinine of cinchona, atropine of belladonna? Is the measure of a drug summed up even by its total alkaloidal contents? Pharmacology would answer no. The alkaloids separate from the drug, while presenting actions that resemble those of the drug itself, by no means replace or fully represent it. A statement by Prof. John U. Lloyd in respect to belladonna may stand for all drugs containing alkaloids:

"Neither a solution of atropine nor of the salts of atropine or hyoscamine in proportion to correspond to those obtained from the alcoholic extract or tincture of belladonna, seems to possess the full qualities of the alcoholic extract or a percolate of good belladonna. Hence, admixtures of extractive with the purified alkaloids cannot fully replace natural belladonna extractives that are of the same alkaloidal proportions.

"For this reason, phyto-chemical analysis does not altogether determine the comparative therapeutic value or physiological energies of belladonna preparations, or that such as are deficient in alkaloid are correspondingly inferior."

In the drug under consideration, an assay[1] from various authorities shows, besides the alkaloids named, sixteen other substances set apart and named. Some of these groups include a still larger number of separate constituents. Are these constituents no factor in the influence of the drug upon the organism? The physiological action of the drug, as reported by a host of observers, is far different from that of caffeine or any drug of the caffeine group. One record of observations, showing its influence upon muscular contractions, shows that caffeine acts upon the height of the contraction. The action of caffeine increases these, but the effect is of short duration, the amplitude being very restricted. The muscle is

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[1] Caffeine . . . . . 2·348
Theobromine . . . . . 0·023
Kolanin . . . . . 1·290
Fat . . . . . 0·734
Essential oil . . . . . 0·081
Resin . . . . . 1·012
Tannin . . . . . 1·591
Glucose . . . . . 2·875
Saccharose . . . . . 0·612
Mucilage . . . . . 3·040
Starch . . . . . 30·990
Dextrine . . . . . 2·130
Soluble salts . . . . . 0·070
Ash . . . . . 3·325
Albuminoids . . . . . 6·325
Coloring . . . . . 2·561
Moisture . . . . . 10·117
Cellulose, etc. . . . . 30·876

100·000

exhausted as rapidly, even more so than in the normal state. The drug kola acts upon the number and intensity of the contractions. The duration of the contractions is greater, the amplitude is larger and longer sustained. The decrease which follows is in a very regular progression. (DuBoise.)

Dr. H. Marie has shown, by a series of comparative tracings, that with caffeine the starting contractions are very elevating, but there is a sudden fall reaching below the starting point; while with kola there is a gradual elevation, which is continued until the drug begins to lose its influence, when the descent is very regular and gradual to the normal point. It is characteristic of caffeine and of other stimulating drugs that there is a depressing action, but there is none with kola. This has been verified by Drs. Smith and Leuf, who, in connection with Dr. Woodbury, recently made some interesting studies of this drug. A series of sphygmograph tracings made by them show an undoubted increase of the pulse and heart action, with no reaction thereafter. Thus we can see that the free alkaloids by no means account for the full value of the drug. The action of the other constituents, save one or two, has been barely touched upon. The essential oil has been defined as a tonic of the generative organs. Whatever action or influences lie in the substances grouped under the head of resinous matter and fatty bodies, etc., at present are unknown. In the light of pharmacology, one constituent, however, seems to be far superior in power and action to that of the other alkaloids, and gives the drug its place and rank. It is the substance termed kolanin. Observers have reported that this substance separated from the drug (containing, of course, no free alkaloids) "in very small amounts, increases the intensity and duration of the muscular contractions." The amplitude of the contractions is preserved longer than with the drug itself. The conservation of the muscular energy is in marked contrast with that of the alkaloids separated from the drug, exercising a well-defined action peculiar to itself. Dr. Edouard Heckel strongly reiterates and produces a vast amount of testimony as to the marked difference and superiority between the action of kolanin and that of the free alkaloids from the drug, and of the other substances of this class. Several other observations made recently in this country show a very marked action of this drug after exhaustion of all the free alkaloids. But, so far, all our studies upon this

plant and those of its class have given but a feeble light upon their whole nature. There are still formidable difficulties to surmount before we can say we have reached the ultimate truth. From a chemical point of view, the three presumable ultimates separated seem to carry in part the energy of the original plant. Of these three, two are alkaloids, of which we can sum up our knowledge by saying they are very closely related, yet they are very different. We do not know as to their origin, are not agreed as to when they begin to form, cannot tell how far the life and death processes within the plant, or how greatly the chemical reactions in our test tubes, have had to do with their formation, their increase or decrease in amount. When we have separated these two alkaloid bodies and given a chemical measure to the drug, there remains in our apparently worthless residue one substance at least, which has been named kolanin, to which pharmacology assigns a higher value than to all the rest. Chemistry can only, by hard work, partly pull it to pieces. It has not yet fully decided as to its final products.[1]

Then we have the ferment body kolazym. Authorities sum up our present knowledge of this class of substances by saying: "Chemically, we know nothing of them, except that an apparently small and immeasurable quantity may affect the constitution of a large quantity of certain other chemical compounds. Their action seems to be the breaking up of large molecules with which they come in contact with smaller molecules." The most that we can say of kolazym is that it is present in the plant and can define its apparent powers. Among the many problems that arise, may we not rightly ask that if by any means we could gain full control of this plant in its manifold stages of life, could we so direct its course that it might go on at our command, producing the peculiar glucosidal body kolanin, could we so govern the action of this ferment as to compel the continuous production of glucose, caffeine and other products? Are conditions possible whereby the yield of glucosides and consequent alkaloids could be increased? Could we here secure a perpetual fountain of chemical products? At

[1] In manipulating the tannin-like compound of Knebel, it is extremely difficult to readily effect a complete separation of the alkaloids. They are either very adherent or form slowly during the breaking down of the original substances, so that, at times, even after hours, extending into days of extraction, faint reactions of caffeine are observed.

present, we dare not even attempt a penetration into the depth of the dead or the vitalized plant as to the compounds we have grouped in our assay as "matters." We may, therefore, turn from our chemical research to the pharmacist's ever-ready crucible, his trained and trusted senses. Take an undried seed of our Sterculia plant, prick through its skin coating or break it open. Mark the result. In a space of time that is not measurable, the color of the flesh within the tissue assumes an orange brown color rapidly extending over the whole abrasion. It goes on until the whole structure assumes this hue. What are those wondrous transformations that take place before our eyes? Is it not reasonable to assume that if our assay had been made before the tissue had been broken, it would have given different results than if made a few seconds afterwards? In this little act have we not in some way loosened the dormant chemic life stored within, and made its operations visible? Who can measure the infinitesimal energies evolved? By the prick of a pin we have started a chemical factory in motion, have involved reactions, equations so great that the scientific mind cannot calculate them. Bite off a piece of the nut and chew it. At first the taste is bitter and acrid; under the grinding and mastication this changes to a sweet. The tongue and palate reason out glucose without the aid of Fehling's solution. Swallow the juice or the masticated substance, put your finger upon the pulse or heart, measure the beats and their force. They are stronger and more regular. Measure the contractions of muscular energy, try their vigor and test their power of endurance. The intensity and force is amplified. The brain, nerve and muscle have received an impetus and derived power from the energy stored within a little nut-shell. Is it because the plant contains the essence of energy or the alkaloid of power? Can we not more truly say that there is a definite chemical affinity between the several molecules of its constituent compounds and the molecules of the nerve organism, with stimulation and vigor as links in the chain? The native users of this plant endowed it with miraculous powers. An Arabian physician, a few centuries ago, named it the "tree of heaven." To-day, the medical and lay journals of Europe and America tell a story of a "wonderful tropical nut," "a marvellous drug from Africa." This somewhat crudely indicates our exact knowledge concerning it. A distinguished American botanist recently described this plant as, to him, the most fascinating and myste-

rious specimen of Nature's handiwork. A professor in one of our pharmacy colleges says that he dimly sees within and through its mysterious processes the key to all our alkaloid-bearing plants. When the door shall be wide opened and all is made plain, the influence and value of the discovery to science and medicine, he believes, will be so great that it may be counted with the "proin" of Berzelius, the "dawn of the day."

NOTE ON THE CHEMICAL COMPOSITION OF SOME MUCILAGES.[1]

By K Yoshimura.

The mucilage, or saccharo-colloids, hitherto analysed, have been found to consist, in most cases, of saccharo-polyanhydrides of either glucose, galactose, mannose, or arabinose. Only in one case was the mucilage shown to consist of a mucin (*Ishii*, Vol. II, No. 2 of this Bulletin).

Although such compounds are widely distributed in the vegetable kingdom, they have been investigated but in a very limited number of cases. As it is of physiological interest to know the composition of mucilages in as many plants as possible, I have examined those of the following species:

(1) *Sterculia platanifolia* (young shoots).[2]
(2) *Colocasia antiqurum* (tuberous roots).[3]
(3) *Opuntia* (fleshy stem).
(4) *Vitis pentaphylla* (stems and leaves).
(5) *Œnothera Jaquinii* (stems and leaves).
(6) *Kadzura Japonica* (young leaves and stems).

The concentrated slimy extracts were precipitated with strong alcohol, and the precipitates, after having been washed with alcohol, were boiled with sulphuric acid of 2–4 per cent. for 2–5 hours, the liquid neutralized with barium carbonate, and the filtrate evaporated to a syrup.

A portion of this syrup was evaporated with nitric acid to observe whether mucic acid was formed.

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[1] From Bulletin of Imperial College of Agriculture, Tokio, Japan. Vol. II, No. 4.

[2] The mucilage of *Sterculia platanifolia*, as well as that of *Kadzura Japonica*, finds technical application in this country, being used for sizing paper, etc.

[3] The tuberous root stock of *Colocasia antiquorum* serves as a valuable food in this country, and is hence cultivated to a large extent.

Another portion was mixed with a cold concentrated solution of acetate of phenylhydrazine to observe whether mannose-phenylhydrazine was formed.

Another portion was examined with phloroglucin and hydrochloric acid for the presence of pentoses. And, finally, the osazones were made in the usual manner, and, after purification by recrystallization from dilute alcohol, their melting points were determined. In this manner I was enabled to come to the conclusion that the mucilage of *Sterculia platanifolia* consists of a mixture of araban with some galactan; and that of *Colocasia antiquorum*, since it gave neither mucic acid nor the pentose nor mannose reaction, but an osazone which was proved to be identical with phenylglucosazone, consists probably only of a polyanhydride of *d*-glucose.

The mucilage of *Vitis pentaphylla*, as well as that of *Opuntia*, consists principally of galactan, while those of *Œnothera Jaquinii* and of *Kadzura Japonica* contain galactan and araban.

THE CHEMISTRY OF INDIAN HEMP.[1]

An attempt has recently been made by F. Marino-Zuco and G. Vignolo to determine definitely what are the active principles of *Cannabis indica* (*vide Gazetta Chimica Italiana*, 1895, part 1, pp. 262–268).

On exhausting the crude drug, by boiling it with water acidulated with sulphuric acid, they obtained an alkaloidal substance which, when converted into hydrochloride, formed a colorless, deliquescent, crystalline mass, about 4 or 5 grammes only being obtained from 50 kilos of the drug. The physiological action of this salt showed it to be a powerful cardiac depressant, much more active than the product from *Cannabis sativa*.

But the authors have succeeded only in adding to the difficulties which already beset the subject. Polli has pointed out that vegetable acids destroy or invalidate the physiological action of *Cannabis indica*. It was not to be expected, therefore, that still stronger acids would extract the active principle or principles on which the value of the drug depends, the chief value of *Cannabis indica* being as a soporific and calmative in the sleeplessness of melancholia, and as

[1] *Pharmaceutical Journal*, December 21, 1895.

an anti-spasmodic in tetanus, etc., one of its most marked characters being its peculiar action on the brain.

The experiments of T. and H. Smith, in 1846, showed that the soporific and other properties of the drug were contained in the resin, and, during the last fifty years, no further information of practical value on the subject has been forthcoming. In 1876, Preobrensky obtained from Indian hemp a volatile alkaloid, supposed to be identical with nicotine, but Dragendorff suggested that this was due to tobacco mixed with the drug, the two being often smoked together. In 1881, Siebold and Bradbury extracted a volatile alkaloid, in very minute quantity, to which the name cannabinine was given, and in 1883, Matthew Hay obtained, in minute quantity, a crystalline alkaloid which possessed a tetanic action. This was called tetano-cannabine, and was stated by Jahns, in 1889, to be identical with choline. In 1891, H. T. Smith extracted an alkaloid of varnish-like consistence, with an odor resembling that of coniine, and forming a sulphate that could be crystallized from alcohol. The cannabin tannate of Merck (1889), the pure cannabin of Bombelan, and the cannabindine of Kobert, can scarcely be regarded as pure active principles.

The chemistry of this remarkable and powerful drug still remains to be elucidated, therefore, and the active principles to which its complex action is due yet await isolation. It may, perhaps, serve as a hint to investigators, to recall a statement which appears in Schlimmer's (Persian) "Pharmacopœia" (p. 102), from which it appears that the dervishes make an extremely somniferous preparation by boiling the tops of Indian hemp in fresh butter or oil of almonds. "Of this a sufficiently minute quantity introduced into an ordinary culinary preparation will cause an entire family to sleep for twenty-four or seventy-two hours, without the taste of cannabis being detected." Assuming the intoxicant action and the odor of Indian hemp to be due to a volatile constituent likely to be driven off by the boiling process, the use of oil as a solvent might serve to separate the most important active principle, and another might be separated by distillation. Hitherto most of the processes adopted appear to have yielded products incapable of causing the characteristic action of the drug. It may be pointed out, by the way, that the Bengal drug, in rounded or rolled pieces, is much richer in resin, and three or four times more powerful than the ordinary drug.

EDITORIAL.

PRODUCTION OF SODA IN THE UNITED STATES.

Some facts with regard to the American production of soda have been recently published in the *Engineering and Mining Journal* for January 4th, which are sufficiently interesting to reproduce for our readers.

The production of soda in the United States is increasing rapidly, and the output for the year 1895 was about 161,000 metric tons, counted as 58 per cent. ash.

The great Solvay Works, of Syracuse, N. Y., are preparing to increase capacity by 50 per cent. through their new Detroit Works. The Mathieson Alkali Company, at Saltville, Va., is also preparing to make a large output of ash and caustic during the coming year, and is now working the Castner electrolytic process with excellent results. This company has a magnificent plant, and will, no doubt, become a very important factor in the market.

The neighborhood of Detroit will shortly become a great, if not the greatest, alkali-producing center in the United States. Besides the new Solvay works, already referred to, the Michigan Alkali Works, at Wyandotte; Church & Co., at Trenton; and two other projected works, are all in the vicinity of Detroit.

The Standard Oil Company is also proposing to operate alkali works at Cleveland, O., and there are two or three other projected works in other parts of the country. There is every prospect that, in a few years more, the United States will not only make all the alkali required for domestic consumption, but it will, before many years, export to other markets, as the cost is constantly being reduced by increasing production and by utilizing waste products.

The Castner electrolytic process, above referred to, has been working on a commercial scale for some time now at Oldbury, near Birmingham, England, where caustic soda and chlorine are successfully produced from brine. The alkali solutions obtained contain 20 per cent. caustic, and yield, by direct evaporation, solid caustic of almost chemical purity (78·5 per cent. Liverpool test) a product to this time unknown in the alkali trade. The Castner-Kellner Alkali Company, who own the patents, are putting in a plant at Oldbury of 4,000 horse-power capacity, which will produce 18½ tons of pure caustic soda and 40 tons of bleaching powder daily. The present annual production of caustic soda in Great Britain amounts to 160,000 tons, while that of bleaching powder is 150,000 tons.

S. P. S.

The Zeitschrift des allgemeinen österreichen Apotheker-Vereins, in its issue of January 1st, celebrates its fiftieth anniversary with an enlarged number, made up of original contributions of a high order, from the pens of some of the best-known writers associated with pharmacy in Europe. Professor A. Vogl contributes a paper on *Jaborandi Leaves;* Professor A. Hilger, one on *Columbin and Colombic Acid;* Professor Dr. J. Wiesner writes on the *Source of Dammar;* Professor J. Moeller, on *Liquidamber and Storax*, and Dr. S. F. Hanausek, on *Cinnamon Chips*. A number of these papers are accompanied by illustrations.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

ESSENTIALS OF VEGETABLE PHARMACOGNOSY. A TREATISE ON STRUCTURAL BOTANY, DESIGNED ESPECIALLY FOR PHARMACEUTICAL AND MEDICAL STUDENTS, PHARMACISTS AND PHYSICIANS.

PART I. The Gross Structure of Plants. By Henry H. Rusby, M.D. PART II. The Minute Structure of Plants. By Smith Ely Jeliffe, M.D. With 560 illustrations. New York: D. O. Haynes & Co. 1895.

The book which these authors have produced is, on the whole, a welcome addition to the literature of the pharmaceutical profession.

In Part I, Dr. Rusby, after a brief introduction, takes up, first, the flower, then in succession the fruit, the seed, the embryo, germination, the root, the stem, the leaf and, finally, anthotaxy. This order of presentation of the subjects might well be objected to on the ground that one of the most difficult parts of botany is placed first. But that much more depends upon the method of treatment than upon the point of beginning, is in the present instance well-nigh justified by the result, for the author has made his exposition of the floral structure so simple and clear that the student need find no serious difficulty with it. In fact, the author has succeeded in presenting his whole subject in a very clear and attractive way. Too many works which purport to give only the essentials of a vast subject are mere skeletons, uninteresting, forbidding; but Dr. Rusby's book is far from being of this class. While probably it would not profess to be original in the sense of presenting facts heretofore unknown to science, nevertheless, it is original in the freshness with which already well-known facts are presented. They are presented in such a way as to enlist interest and awaken thought.

The author shows himself to be so much a master of his subject that he need give little heed to the beaten paths. With the instinct of the true botanist, he often prefers to go "across lots," and this fact adds much to the value of the book.

This part of the book is very fully illustrated, and the illustrations, while simply executed, are nearly always telling and true to nature. The larger portion of them are also original. In the opinion of the reviewer, however, the value of these illustrations would have been considerably enhanced had they been accompanied by descriptions. In some instances the plants from which the drawings are made are not even named in the text.

A protest is recorded here against the continued use of the terms *primine* and *secundine* as names for the coats of the ovule. Some recent writers, among them Dr. Rusby, employ the term *primine* to designate the inner coat, because it is the first formed, while they apply the term *secundine* to the outer and later-formed one. Many other botanists, however, reverse the order, calling the outer coat the primine, and the inner the secundine. This is most confusing, and it would be wiser to abandon these names altogether in favor of the simpler terms *inner* and *outer* integuments.

Part II, though on the whole well up-to-date and written in the modern spirit, is scarcely up to the level of Part I. It is less careful in its statements, less free from errors. On p. 115, for example, it is stated that "the lining membrane is called the cell-wall;" on p. 116, that "it (referring to the cell nucleus) consists of a nuclear membrane," etc.; on p. 119, that "starch is

found throughout the vegetable kingdom;" on p. 121, that "microchemically, acids have no effect on calcium oxalate;" all of which statements are more or less misleading.

Also, on p. 126, a drawing of a root-tip is given, and the axial part is pointed out as the periblem, and the zone exterior to this as the plerome, which is not in accord with such excellent authorities as Strasburger and Vines, nor with what Dr. Rusby says in the first part of this same book.

In the accompanying text, on p. 127, the following statement occurs: "*Beneath* this (that is the dermatogen) lies the plerome which gives rise to the fibro-vascular system, and *within* is the periblem, from which the ground tissues arise." (The italics are ours.) This statement renders confusion worse confounded. All of this shows that in Part II the proof-reading was less carefully done than it ought to have been, a defect which, it is to be hoped, a second edition will rectify.

This part is also copiously illustrated and the drawings are good, though it is to be regretted that the author has been obliged to credit nearly all of these to German authors, instead of giving us original ones.

EDSON S. BASTIN.

A STUDY IN PHARMACY. By J. U. Lloyd. Cincinnati, O., 1894.

Something over a year ago, Professor Lloyd commenced mailing to his friends the pages of a work that at first was decidedly a puzzle to them. The first part issued was entitled "Preliminary," the second part "Generalities;" these occupied over two fasciculi, and then the subject of "Experimentation" was taken up. Later, "Chemical and Pharmacal Compounds" were discussed, but still the plan and object of the work were not apparent.

More recently, the author has thrown some light on the drift of the work by discussing the less comprehensive subject, "Capillarity." This subject he has commenced with a short outline of study, and then follows an elaborate list of references to the literature of capillarity. This index commences with the year 1452, and, up to this writing, it has reached the year 1857, with 222 separate references. If the author completes this valuable reference list, which he has copiously amplified with brief abstracts, he will confer a lasting benefit on all those who have occasion to pursue this interesting study.

We hope these contributions will continue to reach us in rapid succession.

THE PRINCIPLES AND PRACTICE OF AGRICULTURAL ANALYSIS. Volume II, Fertilizers. By Harvey W. Wiley. Easton, Pa.: Chemical Publishing Company. 1895.

The first volume of this work was devoted to soils, and was reviewed in this JOURNAL just one year ago. It was then thought that the second volume would complete the work; but the author found that the subject of fertilizers alone made, with index, 332 pages, so it was decided to start a new volume, which is now coming out in monthly parts.

Volume II is divided into four parts: Part I is devoted to "Phosphates and Phosphatic Fertilizers;" Part II considers "Nitrogen in Fertilizers and Fertilizing Materials;" Part III treats of "Potash in Fertilizing Materials and Fertilizers;" and Part IV concludes with a survey of "Miscellaneous Fertilizers."

The analytical side of the subject is very fully discussed, and illustrated with very practical apparatus. To the chemist this volume will be of even more

value and interest than Volume I. The citation of authorities has been judiciously and abundantly made throughout the work.

THE DISCOVERY OF OXYGEN AND ITS IMMEDIATE RESULTS, INCLUDING THE OVERTHROW OF THE PHLOGISTON THEORY.

Reprinted from a series of articles in the *Pharmaceutical Journal*, which, we presume, were from the ready pen of the editor. The reprint makes a pamphlet of 59 pages, and it is a scholarly account of the investigations of Priestley, Scheele, Cavendish and Lavoisier. Its publication at this time is especially opportune, since the one-hundred-and-fiftieth anniversary of the birth of Scheele was celebrated a short time ago, and the centenary of the death of Lavoisier, the founder of modern chemistry, still more recently.

All of these men were more or less connected with pharmacy, as it existed in their day, and this account of them is of interest to pharmacists for that reason. At the same time, it enables one to understand more clearly the wonderful progress that has been made in chemistry during the nineteenth century.

STATE CONTROL IN MEDICINE: an introductory address to the sixty-fifth lecture course of the Albany Medical College. By Willis G. Tucker, M.D.

ON THE RELATIONS OF CHEMISTRY TO EDUCATION. By William H. Seaman, M.D.

An address of the retiring president before the Chemical Society of Washington, D. C.

CONTRIBUTION A L'ÉTUDE DU PSIDIUM POMIFERUM, L. Par Joseph Khouri. Thesis presented to the *École Supérieure de Pharmacie*, Paris, for the diploma of pharmacist of the first class. Paris: Le Bigot Frères. 1895.

ANTITOXINES, VACCINE VIRUS, AND OTHER BIOLOGICAL PRODUCTS, issued by the Biological and Vaccinal Department of the New York Pasteur Institute, New York.

This pamphlet of 28 pages gives some account of each of the serums prepared by the above Institute, and for sale by their agents, Messrs. Lehn & Fink. It is a satisfaction to know that we have the means of producing these serums in this country, and that they are supplied in both the liquid and the dry state.

FORESTRY FOR FARMERS. By B. E. Fernow, U. S. Department of Agriculture. Washington: 1895.

THE COMPOSITION OF EXPIRED AIR AND ITS EFFECTS UPON ANIMAL LIFE. By J. S. Billings, M.D., S. Weir Mitchell, M.D., and D. H. Bergey, M.D. Smithsonian Contributions to Knowledge, No. 989. Washington, 1895.

VIERTELJAHRESSCHRIFT UBER DIE FORTSCHRITTE AUF DEM GEBIETE DER CHEMIE DER NAHRUNGS- UND GENUSSMITTEL. Von Dr. A. Hilger, Dr. J. König, Dr. R. Kayser and Dr. E. Sell. Berlin: Verlag von Julius Springer, 1895.

The third number of the tenth volume of this interesting publication is fully up to the standard of its predecessors. The abstracts cover nearly everything relating to foods, and a valuable bibliography of all recent books on foods and food products is appended.

NOUVEAU PROCÉDÈ POUR LA PRÉPARATION DE GRANDS EXEMPLAIRES DE CRISTAUX. Par Raymond van Melckebeke. Reprint from *Annales de Pharmacie*, Louvain, 1895.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, January 21, 1896.

The fourth of the series of Pharmaceutical Meetings was held in the Museum of the College, at · o'clock.

Mr. Joseph W. England was called to the chair, and the reading of the minutes of the previous meeting was dispensed with.

The first paper, entitled "Kola and Kolanin," was presented by Mr. F. B. Kilmer, of New Brunswick, N. J. (See page 96.) This paper is a valuable one, from a chemical and pharmacological standpoint, as showing the results of the most recent research along these lines, and, with so much data at hand, the value of this drug in therapeutics would seem to be pretty thoroughly established. Mr. Kilmer rendered his paper all the more interesting by showing photographs from the habitat of the kola plants, illustrating their appearance as seen growing in the native forests, and the industries connected with the collection and preparation of the nuts for market, and also by exhibiting specimens of the fresh and dry nuts from various tropical countries, and an original package of the African nuts, as well as some which were partially decomposed, owing to the attack of a fungus growth.

Several important questions were presented in the discussion, which may be summarized as follows: Mr. England desired to know whether kolanin can be obtained in the crystalline form, and also whether the African nuts are superior to those from other countries. Mr. E. M. Boring wished to know in what manner the drug is used by the natives. Prof. Trimble referred to the author's experiment in cutting the fresh nuts under ether to obviate the action of the air on the glucosidal principle, and mentioned the difficulty of extracting the active principle of drugs with chloroform or ether in the presence of moisture, and suggested the use of absolute alcohol in operating upon the fresh drug. He also confessed to some skepticism on the subject of the wonderful physiological properties ascribed to kolanin, and wondered, after all, whether the effects of the drug were not really those of the caffeine which is produced by the action of the ferments in the saliva and gastric liquids on some of the constituents of this drug, and whether the difference between a dose of kola and one of caffeine is not the result of a slower absorption of the caffeine from the kola, since the kolanin must first undergo slow decomposition.

Mr. Kilmer, in replying to the preceding questions, said that he had as yet been able to obtain kolanin only in the amorphous condition; and, in considering the relative value of kola nuts obtained from different localities, the difference in the results, as obtained by analyses, he thought to be due to the method of curing them, and to the proportion of diseased nuts, the latter having been proven to be worthless. He also mentioned the difference in taste between samples that had been carefully dried and those prepared by the natives. This industry is mostly carried on by native women, who select the most perfect nuts and place them in the ground and loosely cover them with leaves and earth, so that the air shall not be entirely excluded. Here they are allowed to remain about one month, when they are examined again and the defective ones rejected. When the yield is small, they are carried over from one season to another, although, in some countries, large quantities are never gathered. The natives all use them and depend simply on chewing them to obtain the effects.

Mr. Kilmer further stated that he had used acidulated alcohol in extracting the fresh nuts, by cutting them under it and macerating, and had obtained different results than when they were previously prepared in the open air. With reference to the active constituents, he said that the testimony of physicians was to the effect that there is a marked difference in action between kolanin and caffeine; and, in considering kolanin as an article of commerce, it is very difficult to separate, and keeps better in solution, the problem of preparing it in an eligible form being one for the pharmacist to work out. Two samples of this substance were shown, one in the moist condition and the other in the dry form, the latter being much darker in appearance, owing to the production of kola red on exposure.

A vote of thanks was tendered Mr. Kilmer for his paper and presentations of photographs and specimens.

The second paper was read by Mr. F. W. Haussmann, and was entitled "The Influence of Certain Medicinal Compounds on the Character of the Urine." (See page 84.) This paper gave evidence of having required no small amount of work in its preparation, and showed how wide the field for study in this branch of chemistry is becoming, and especially so since the introduction of the large class of synthetic remedies, and also how the physician and pharmacist may work with one accord in the development of a science so important in the study of pathological conditions.

The last paper was presented by Mr. Lyman F. Kebler, and was entitled "A Comparison of the More Recent Methods for the Assay of Cinchona Barks." (See page 79.) Mr. Kebler is rendering technical pharmacy high service in thus studying and comparing different assay processes, and, at the same time, a practical advantage is gained in the selection of methods best adapted to the needs of the pharmacist.

Attention was called to two samples of denarcotized opium, and, from the difference in appearance, it would be well for pharmacists to exercise some discrimination in buying this drug.

Mr. Geo. M. Beringer sent samples of liquid vaccine virus which is said to be absolutely aseptic. The liquid previously sterilized is hermetically sealed in glass tubes, and dispensed in them so that no contamination can occur.

Mr. Chas. Bullock presented a specimen of a patented chemical which is used for dyeing purposes. It is called "sal americ," and is a combination of fluoride of antimony and sulphate of ammonium.

On motion, the meeting adjourned.

T. S. WIEGAND,
Registrar.

MINUTES OF MEETING OF THE PHILADELPHIA COLLEGE OF PHARMACY.

William J. Jenks, Vice-President, presided at the stated meeting of College members, held December 30, 1895. Nineteen members were present. As is usual, the minutes of the previous regular meeting were confirmed, and the records of transactions of the Board of Trustees for the months of October, November and December were approved. The Committee on Delinquent Members,

who had recommended an amendment to the By-Laws, in a substitution, Chapter VIII, Article V, now moved the adoption of said amendment, the usual interval of notification having elapsed. (This amendment will be found in full under the College minutes, in the November, 1895, number of this JOURNAL.) It practically provides for a class, to be known and designated as associate members, who shall pay $3 annually *in advance*, instead of $5, the dues of regular, active members. These associate members have all the privileges of active members accorded them, except that they *are not granted the right to vote*, nor *can they hold office*. By compliance with the conditions and terms of payment already established, any associate member may elect to become an active member. This amendment was adopted by a unanimous vote.

It was verbally stated that a Committee of Apothecaries, representing the hospital stewards and naval apothecaries, were about to petition Congress in a bill providing for a better recognition and status of this arm of the National Service, and higher grade of pay; also that this College had been solicited to use its influence in favor of this bill. After discussion, it was resolved that the secretary be instructed to address the Honorable Secretaries of War and Navy, as also the Committee on Naval Affairs, expressing the sense of approval of this College, and urging the favorable consideration of the provisions of the bill.

The Secretary of the Board of Trustees submitted the following names of gentlemen who had been elected honorary and corresponding members, respectively. On motion, the action of the Board was approved, and the nominations confirmed.

Honorary Members: J. H. Maiden, Sydney, New South Wales; Dr. Oscar Loew, Tokio, Japan; P. L. Simmonds, The Charter House, London, England; Prof. F. E. Lloyd, Forest Grove, Oregon; Dr. F. Hoffmann, New York.

Corresponding Members: A. E. Wild, Darjeeling, Bengal, India; William Fawcett, Gordon Town, Jamaica.

HENRY TRIMBLE,
JOSEPH P. REMINGTON,
CHARLES BULLOCK,
} *Committee.*

On motion, meeting adjourned.

WILLIAM B. THOMPSON,
Secretary.

The Agricultural Gazette, of New South Wales, states that there is still living at Kenmore, in excellent health, Mr. Charles Ledger, the man who, forty years ago, after most perilous adventures, introduced the variety of Cinchona Calisaya, known as Ledgeriana, into the island of Java, and not much afterward introduced a flock of alpacas and other animals from South America into Australia, which have been of priceless value to that country. Messrs. Howard & Sons, the great quinine firm, say that the supply of Peruvian bark from Java is almost all from the Ledgeriana trees, the only complaint against this variety being that it has turned out so rich that the trees are supplying too much quinine for the world to consume. Perhaps the quantity of bark which is now produced every year from seed furnished by Mr. Ledger cannot be short of 10,000,000 pounds, and to him, more than any one else, perhaps, is due the fact that quinine has been brought within the means of the very poorest.